Chapter 1

Penetration, Expansion, and Trends of Digital Technologies as "Social Infrastructure"

The year 2025, a quarter into the 21st century, will mark the 100th anniversary of the start of radio broadcasting in Japan (1925) and the 40th anniversary of the liberalization of telecommunications (1985), which saw the privatization of Nippon Telegraph and Telephone Public Corporation and the liberalization of telecommunication business for private companies.

When considering information and communication infrastructure, the first thing that comes to mind is communication and broadcasting networks that form the basis for information distribution. However, with the spread of the Internet and the advancement of digital technologies in all aspects of our society and economy at present, the digital ecosystem is becoming increasingly essential and it continues to expand year by year as it performs social infrastructure functions. As the impact of digital technologies and services on our lives, society and economy is expected to expand significantly in the future, both positively and negatively, it is becoming more important than ever to address challenges in the digital field and to use digital technologies to solve and mitigate social issues.

In light of the current situation in which the expansion of the digital ecosystem as social infrastructure is having a major impact on our society and economy, this Special Feature in the White Paper is titled "Digital Technologies as Spreading 'Social Infrastructure,'" and provides an overview of the trends in the expansion of the digital ecosystem, which functions as social infrastructure, the trends in the explosive development of artificial intelligence (AI), which is likely to permeate and influence various areas of the digital ecosystem and become a fundamental element supporting the digital society, the rise of foreign business operators that are major players in such digital sector, and the situation in Japan. Based on this, against the backdrop of today's global situation and changes in the natural environment and society, the Special Feature provides an overview of today's challenges brought about by the advancement of digital technologies and their expanding impact on society and responses to such challenges, as well as the role and prospects for digital technologies in resolving and mitigating major social issues in Japan.

Chapter 1 provides an overview of the current state of the expansion of the digital ecosystem, which currently functions as social infrastructure, the progress and utilization of AI, which is expected to become a fundamental element supporting the digital society in the future, the rise of foreign business operators in the digital field, and the current situation in Japan. Taking into account the current global situation and changes in the natural environment and society, Chapter 1 will also provide an overview of the prospect for the future digital society and the role that the evolving digital technologies should play.

Section 1 Expansion of the Digital Ecosystem, which Functions as Social Infrastructure

As digital technologies permeate society and the digital ecosystem expands as an important and essential "social infrastructure" in social life and corporate activities, including social networking service platforms and cloud services, major changes are occurring in information gathering, communication, consumption behavior, and corporate economic activities.

This section provides an overview of the changes and expansion of the digital field, which is highly important and essential in socio-economic activities, taking into account trends in the use of digital technologies in social life, corporate activities, administrative agencies, etc.

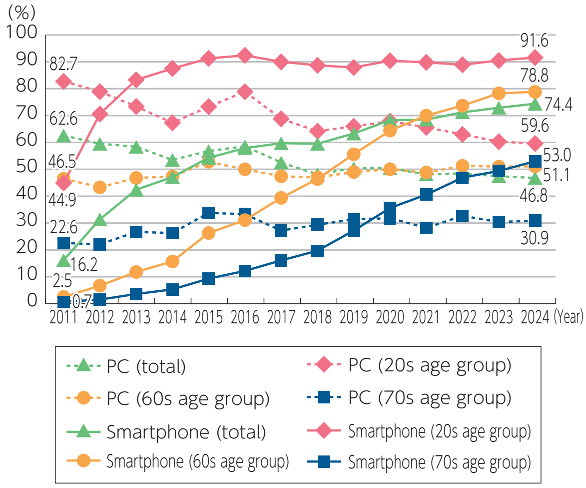
1. Permeation and Expansion of Digital Technologies in Social Life

(1) Internet connection devices

In the past, personal computers were the main devices used to connect to the Internet, but with the increasing speed of mobile networks, cheaper mobile phone charges, and the diversification of applications available on smartphones, people, including the elderly, are shifting to smartphones.

For example, the rate of smartphone usage as an Internet connection device was 16.2% in 2011, but increased to 74.4% in 2024, surpassing the rate of PC usage as an Internet connection device in 2017 (2017: smartphones (59.7%), PCs (52.5%)). Smartphones have become the mainstream Internet connection device, including among the elderly, with significant increase in both those in their 60s (2.5% in 2011, 78.8% in 2024) and those in their 70s (0.7% in 2011, 53.0% in 2024) **(Figure 1-1-1-1)**.

Figure 1-1-1-1 Changes in the usage rate of Internet connection devices (PCs*, smartphones)



* It was "Home computer" before 2016

(Source) Prepared from the MIC "Communication Usage Trend Survey"

Figure (related data)Changes in the usage rate of Internet connection devices (smartphone) (by age group)
Source: MIC "Communication Usage Trend Survey"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00002
(Data collection)

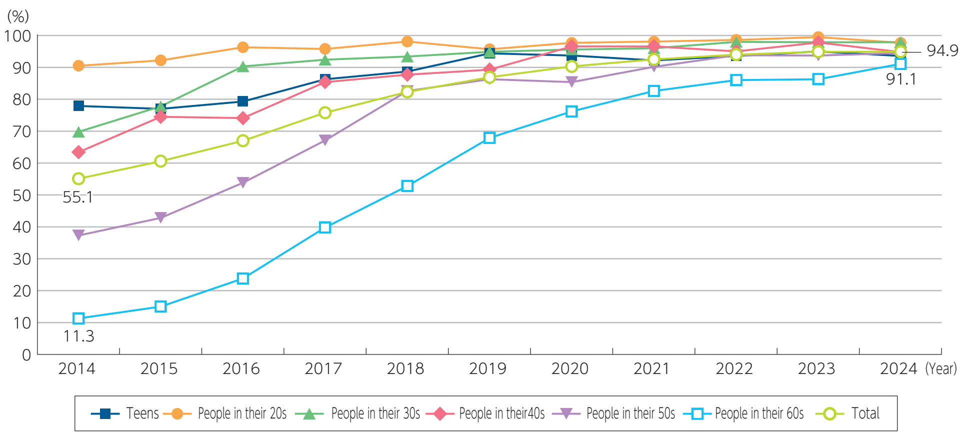
Figure (related data) Changes in the usage rate of Internet connection devices (personal computer) (by age)
Source: MIC "Communication Usage Trend Survey"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00003
(Data collection)

(2) Communication tool/SNS

The means of communication has shifted to mobile phones, and LINE has a major presence today. For example, overall LINE usage increased from 55.1% in 2014 to 94.9% in 2024[1]. Even among the elderly, the usage rate among people in their 60s increased from 11.3% in 2014 to 91.1% in 2024 **(Figure 1-1-1-2)** .

Usage rates of other social networking services (SNS), such as X (formerly Twitter) and Instagram, are also growing. While usage rates tend to be higher among younger generations in general, in 2024, the overall usage rate of X and Instagram was approximately 50%, and more than 40% of people in their 50s used them, indicating that usage is expanding across a wider range of age groups (**Figure 1-1-1-3**).

Figure 1-1-1-2 Changes in the LINE usage rate (by age group)[2]

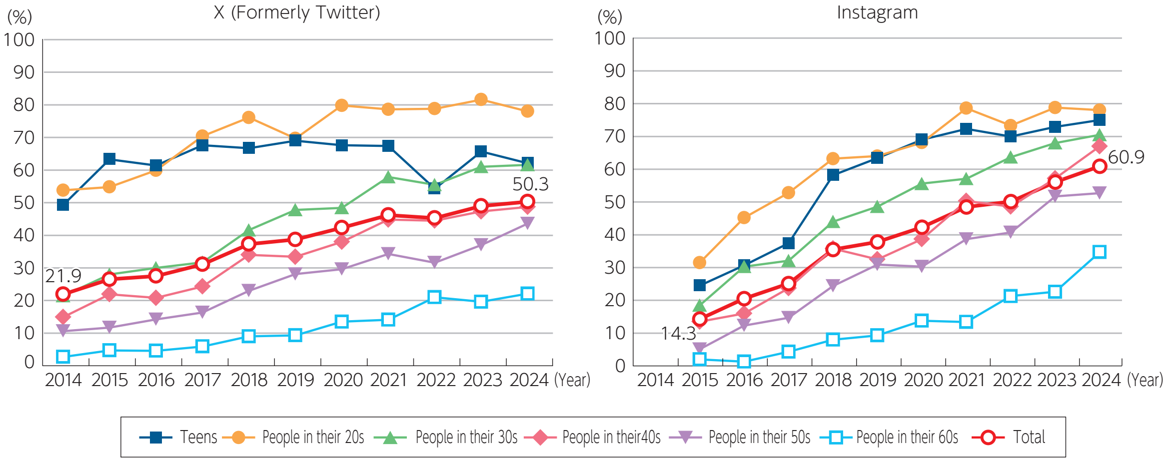


(Source) Prepared from the MIC "Survey on Information and Communication Media Usage Time and Information Behavior"

[1] The total usage rate for 2024 is calculated based on usage rates for people in their teens to 60s.
[2] The total usage rate for 2024 is calculated based on usage rates for people in their teens to 60s.

Figure (related data) Changes in usage rates of voice call function on mobile phones and LINE
Source: Prepared from the NTT DOCOMO Mobile Society Research Institute "Mobile society white paper 2024 Edition"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00005
(Data collection)

Figure 1-1-1-3 Changes in the SNS usage rate (X, Instagram) (by age group)[3]

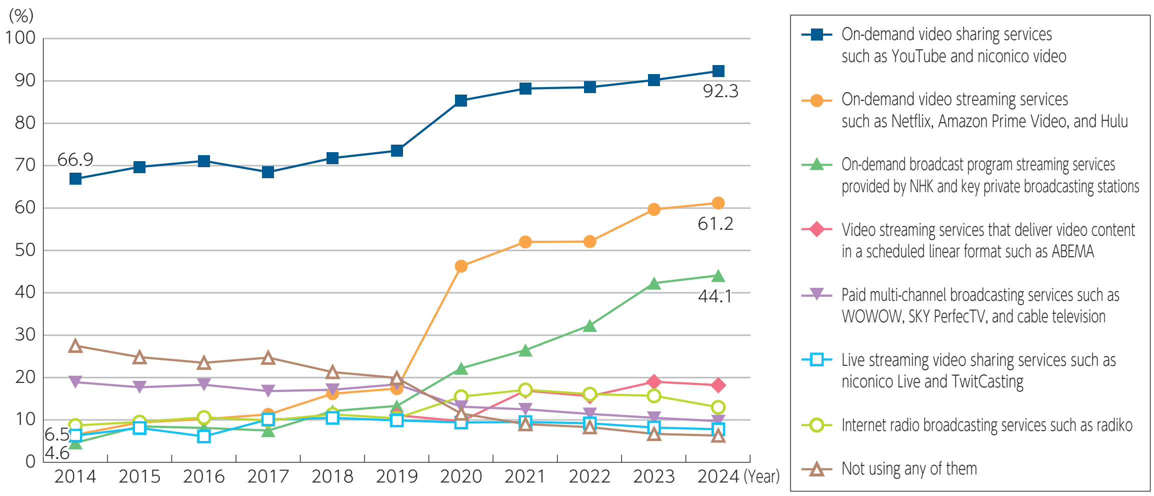


(Source) Prepared from the MIC "Survey on Information and Communication Media Usage Time and Information Behavior"

(3) Video sharing and distribution services

The number of video service users has increased significantly since 2020 as people took advantage of the time they spent at home during the COVID-19 pandemic, and usage rates still remain high. In particular, there has been an increase in the number of users of on-demand video sharing services such as YouTube, on-demand video streaming services such as Netflix, and on-demand broadcast program streaming services provided by television stations **(Figure 1-1-1-4)**.

Figure 1-1-1-4 Changes in the usage rate of video and radio services using the Internet[4]

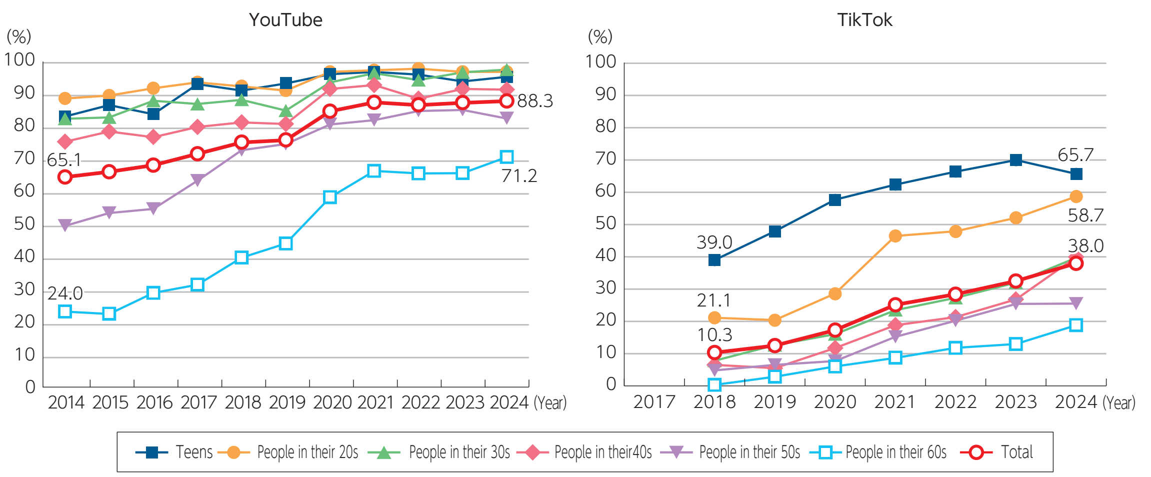


(Source) Prepared from the MIC "Survey on Information and Communication Media Usage Time and Information Behavior"

Looking at usage trends for individual video sharing services, YouTube, for example, shows high usage rate across almost all generations, exceeding 80% of all generations up to their 50s in 2024, and over 70% of people in their 60s are using it. TikTok usage has grown significantly in recent years, especially among teenagers and people in their 20s, and it exceeded 50% among both generations in 2024 **(Figure 1-1-1-5)** .

[3] The total usage rate for 2024 is calculated based on usage rates for people in their teens to 60s.
[4] The total usage rate for 2024 is calculated based on usage rates for people in their teens to 60s.

Figure 1-1-1-5 Changes in usage rates of YouTube and TikTok (by age group) [5]



(Source) Prepared from the MIC "Survey on Information and Communication Media Usage Time and Information Behavior"

Additionally, among video streaming services, Amazon Prime Video and Netflix have seen particularly high usage rates in recent years.

Figure (related data) Changes in usage rates of various video services
Source: Prepared from the MIC "Survey on Information and Communication Media Usage Time and Information Behavior"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00009
(Data collection)

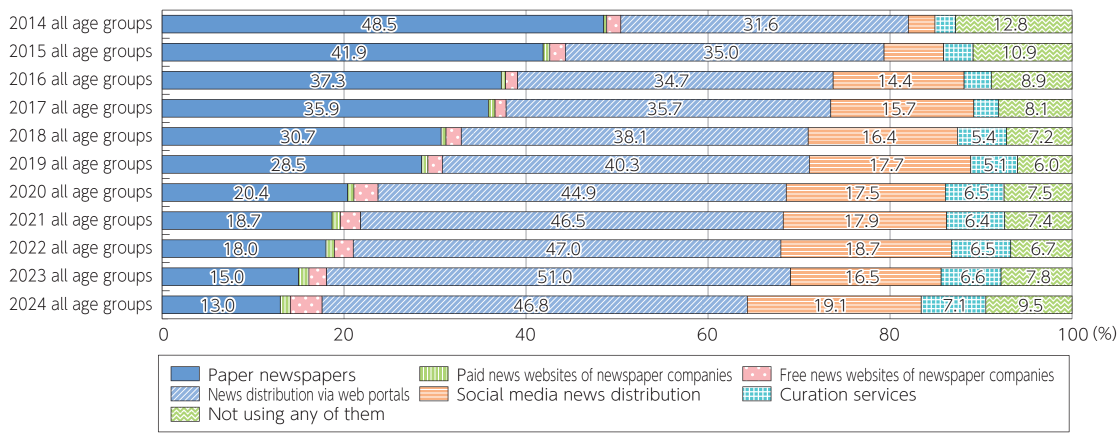
(4) Information gathering means

With the expansion of Internet portal sites and news distribution via social media, and the increasing SNS usage rate, the Internet is becoming an important means for people to gather information.

For example, the most commonly used text-based news services are news distribution via portal sites, news distribution via social media, and curation services, [6]the sum of which accounted for 36.8% in 2014 and rose to 73.0% in 2024[7] **(Figure 1-1-1-6)** .

Additionally, according to a survey conducted by the Japan Press Research Institute in 2024, when asked about their impressions of each medium, a higher percentage of all generations up to their 50s answered that the Internet was "an indispensable source of information" than newspapers or television, suggesting that the Internet is becoming increasingly seen as an indispensable source of information **(Figure 1-1-1-7)**.

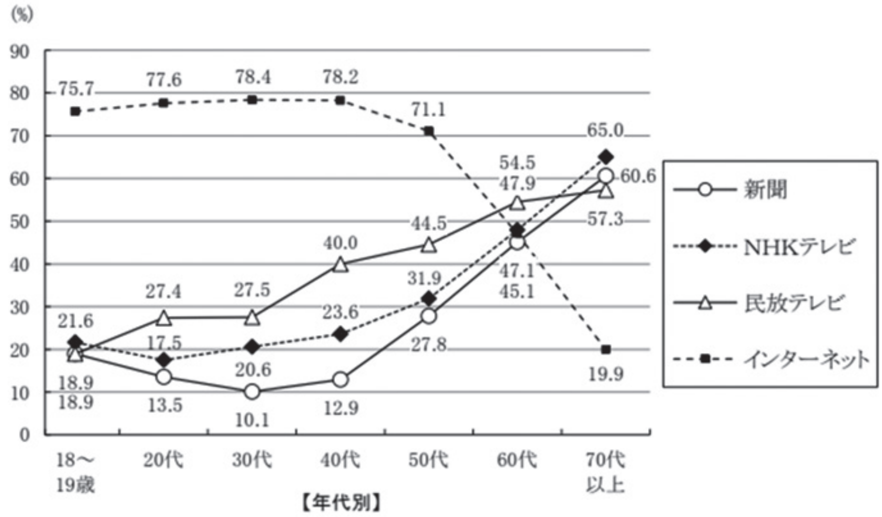
Figure 1-1-1-6 Changes in the most commonly used text-based news services [8]



(Source) Prepared from the MIC "Survey on Information and Communication Media Usage Time and Information Behavior"

[5] The total usage rate for 2024 is calculated based on usage rates for people in their teens to 60s.
[6] News apps such as SmartNews, Gunosy, and NewsPicks
[7] The total usage rate for 2024 is calculated based on usage rates for people in their teens to 60s.
[8] The total usage rate for 2024 is calculated based on usage rates for people in their teens to 60s.

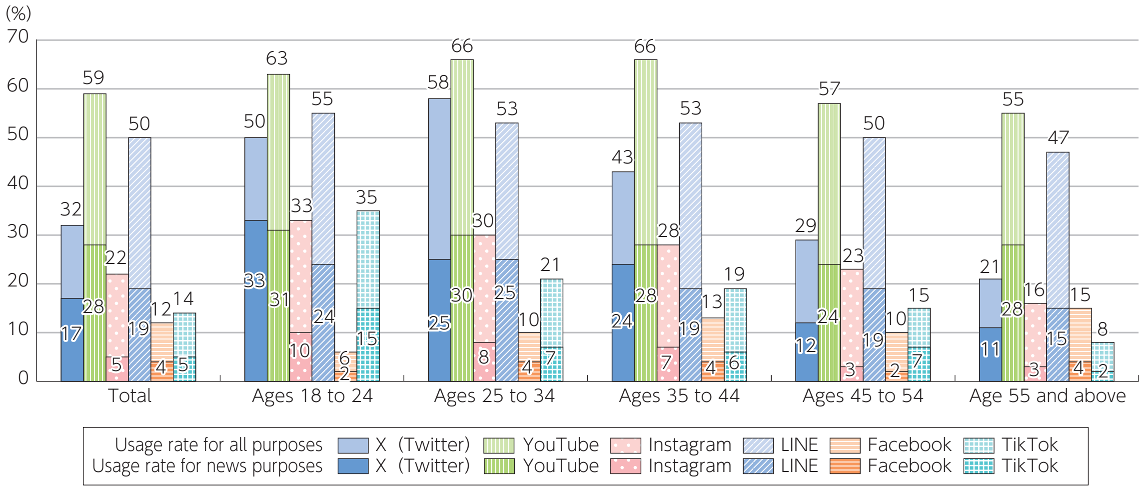
Figure 1-1-1-7 Indispensability of each medium as a source of information (by age group, 2024)



(Source) Japan Press Research Institute (2024) "The 17th National Public Opinion Survey on Media"

Furthermore, according to a survey conducted in 2024 by an organization of the University of Oxford in the UK, the usage rate of social media for news purposes in Japan is high for YouTube, X, and LINE. In particular, about 30% of all generations use YouTube for news purposes (**Figure 1-1-1-8**). On the other hand, in terms of media reliability, the reliability of the Internet is lower than that of TV and newspapers for all generations (**Figure 1-1-1-9**) .

Figure 1-1-1-8 Usage rate of social media as a news source (by age group, all respondents in Japan, 2024) [9]



(Source) Prepared from the Reuters Institute for the Study of Journalism "Digital News Report" (2024) [10]

Figure 1-1-1-9 Reliability of media (by age group, 2024)

		Television	Newspaper	Internet	Magazine
Total	All age groups (N=1,800)	58.2%	59.9%	27.0%	15.7%
Age groups	Teens [N=140]	52.1%	57.9%	24.3%	18.6%
	People in their 20s [N=218]	46.8%	50.0%	28.0%	17.4%
	People in their 30s [N=237]	43.5%	43.0%	29.1%	17.3%
	People in their 40s [N=306]	54.6%	54.9%	31.7%	19.0%
	People in their 50s [N=330]	63.0%	66.4%	33.0%	15.2%
	People in their 60s [N=271]	66.4%	69.4%	22.5%	13.3%
	People in their 70s [N=298]	72.1%	71.1%	18.5%	11.4%

(Source) Prepared from the MIC "Survey on Information and Communication Media Usage Time and Information Behavior"

[9] In this survey, respondents were asked whether they used the Internet within the past week. On the other hand, in MIC "Survey on Information and Communication Media Usage Time and Information Behavior" (Figure 1-1-1-2, Figure 1-1-1-3, Figure 1-1-1-5), respondents were asked about the use of the Internet without particular restrictions on the period of use.

[10] https://reutersinstitute.politics.ox.ac.uk/digital-news-report/2024

(5) Shopping, payment

Internet use for shopping purposes is also increasing year by year. According to a survey by the Ministry of Economy, Trade and Industry (METI), the size of the e-commerce (EC) market between businesses and consumers (B2C) has been expanding in recent years in the areas of merchandise sales, services and the digital field. The items available for purchase through e-commerce are expanding beyond books and home appliances to include household goods and clothing.

Payment methods are shifting from cash to cashless payments. According to a survey by the METI, the percentage of cashless payments has been steadily increasing, reaching 42.8% in 2024. The use of QR code payment is also continuing to expand, accounting for 9.6% of all cashless payments as of 2024.

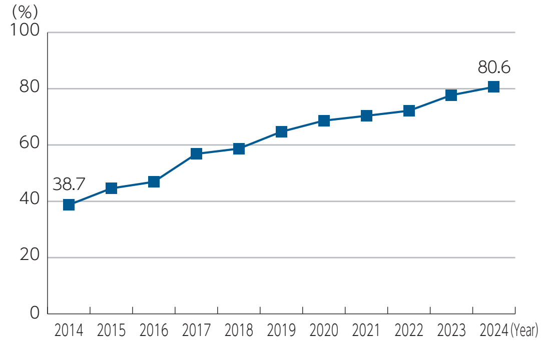
Figure (related data) Changes in cashless payment amounts and its percentage
Source: METI "2024 Ratio of Cashless Payment Among the Total Amount Paid by Consumers Calculated"
< https://www.meti.go.jp/press/2024/03/20250331005/20250331005.html> (Reference May 9, 2025)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00016
(Data collection)

2. Penetration and Expansion of Digital Technologies in Corporate Activities

(1) Cloud services

The use of cloud services in general by companies is expanding year by year. Combining company-wide use and use at some business locations or departments, 80.6% of companies used cloud services in 2024 **(Figure 1-1-1-12)** . The services for which cloud is used are diverse, with particularly high usage rates for "file storage and data sharing," "internal information sharing and portal," "email," "payroll, financial accounting, and human resources management," and "schedule sharing," and cloud usage continues to grow steadily **(Figure 1-1-1-13)** .

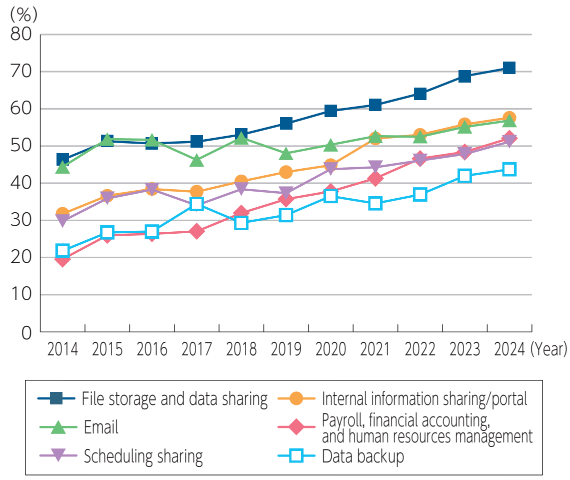
Figure 1-1-1-12 Changes in the use of cloud services



* Combined company-wide use and use at some business locations or departments

(Source) Prepared from the MIC "Communication Usage Trend Survey"

Figure 1-1-1-13 Changes in the use of cloud services (by usage purpose)



* The survey is aimed at companies that use cloud services.

(Source) Prepared from the MIC "Communication Usage Trend Survey"

(2) Customer contact and transactions between businesses

The use of digital space is becoming increasingly important for information dissemination including advertising from companies to customers.

Internet advertising expenditures reached 3.7 trillion yen in 2024, accounting for 47.6% of total advertising expenditures. Since the Internet overtook the four mass media outlets[11] in 2021, the gap has been widening.[12]

Additionally, the use of SNS as a corporate advertising medium is also expanding. According to a survey by Teikoku Databank, in 2023, 40.8% of companies used SNS to disseminate information externally, with the rate of SNS use being particularly high among B2C companies.

The size of business-to-business (B2B) e-commerce (EC) market is expanding as EC advances, and according to a survey by the METI, the EC rate was 40.0% in 2023.

Figure (related data) SNS usage status for external parties
Source: Teikoku Databank (2023) "Questionnaire on trends in the use of SNS in businesses"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00019
(Data collection)

Figure (related data) Changes in the size of the business-to-business e-commerce market
Source: METI "E-commerce market survey"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00020
(Data collection)

3. Penetration and Expansion of Digital Technologies in Administrative Services

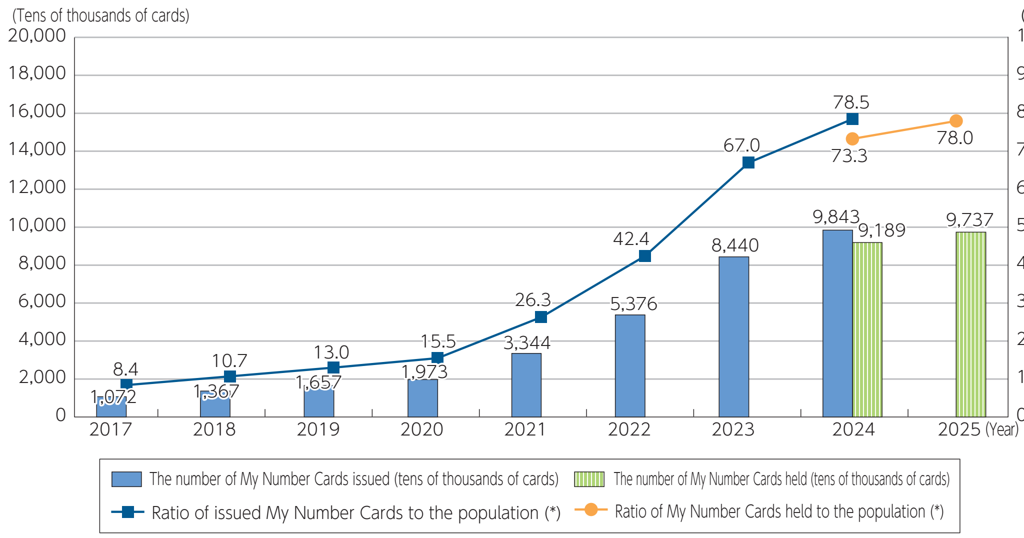
Administrative procedures, one area where digital technologies are being utilized in government agencies, are also seeing increased use of online services.

For example, the number of My Number Cards held by the population (calculated by subtracting cards abolished due to death or expiration from the total number issued), which serve as the basis for identity verification in electronic applications, reached 78.0% of the population as of the end of February 2025 (**Figure 1-1-1-14**) .

The use of electronic filing is also increasing in various fields. For example, according to the National Tax Agency, out of the total number of filing procedures, the proportion of corporate tax returns using e-Tax reached 86.2% as of FY2023, and 69.3% for income tax returns, indicating steady increase. In particular, the use of personal income tax returns has increased significantly from 44.0% in FY2018, due to factors such as the widespread use of My Number Cards.

In the "Priority Plan for Realizing a Digital Society," the online usage rate for procedures that local governments are expected to prioritize for going online was 57.6% in FY2022[13].

Figure 1-1-1-14 Changes in the Status of Spread of My Number Card



* The number of My Number Cards issued as of March of each year (April for 2019, January for 2025)

(Note) From 2024 onward, the number of My Number Cards held (calculated by subtracting cards abolished due to death or expiration from the total number issued) is listed

(Source) Prepared from MIC "The Status of Issuance of My Number Card"

[11] Newspaper, magazine, radio, television media
[12] Refer to "Advertising" in Section 3, 2 (2), Chapter 1, Part II
[13] Refer to "Trends in digital usage in administration" in Section 11 (3), Chapter 1, Part II

4. Importance and Indispensability of Digital Services in Everyday Life and Corporate Activities

(1) Everyday life

A questionnaire survey for individuals was conducted regarding their usage of digital services, such as, among others, information gathering and dissemination on SNS and shopping. In the survey, respondents were asked about the impact of each digital service for which they said "I usually use" if the service was suspended, and the possibility of using other services as an alternative.

As a result, regarding the impact of a service suspension, over 40% of respondents answered, referring to stock trading, online banking, payment, settlement, or messaging services, if they are suspended, "It would cause major disruption to their daily lives." As for the impact of the service suspension, a high percentage of respondents said, regarding a wide range of digital services, "Although there are alternative services, it would be very inconvenient." The results are considered to indicate that a wide range of digital services are widely recognized as being high in their "indispensability" and "importance."

When respondents were asked about the challenges of replacing the services they currently use with services from other companies, a high percentage of respondents cited issues with "SNS" and "messaging services" in terms of connections with people and data, and with "schedule management" and "file sharing" in terms of the difficulty of transferring stored data. These reasons are considered to partly explain why the users of digital services have difficulty changing to alternative digital services provided by other companies.

Figure (related data) Impact of service suspension (Services the respondents said "I usually use")
Source: MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00023
(Data collection)

Figure (related data) Possibility of changing to other alternative services (Services the respondents said "I usually use")
Source: MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00024
(Data collection)

(2) Business activities

Regarding the operations that use cloud services in companies, a questionnaire survey was conducted on each cloud service that respondents answered, "We use it (either almost all, about half, or only some)" to find out the impact of the service if suspended and the possibility of replacing it with another service.

As a result, it was found out that the cloud services used by companies that have a significant impact, such as "it would be difficult to continue business activities without the service" or "it would cause major disruption to business operations without the service," cover a wide range of fields, including "email," "file storage and data sharing," "internal information sharing," "payroll, financial accounting, and human resources management," and "data backup." This is considered to indicate that cloud services have become an important and indispensable part of today's business activities.

Additionally, when asked about challenges in replacing their current cloud services with other cloud services or in-house built systems, respondents cited increased operational costs and reduced service levels as the most significant issues across many services. On the other hand, the percentage of respondents who said there were no alternative services was generally low. Regarding the cloud services currently used by companies, even if there are alternative services available, it is suggested that it would be difficult to replace them with other services from the perspective of cost and service level maintenance.

Figure (related data) Position of cloud services currently in use
Source: MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00025
(Data collection)

Figure (related data) Possibility of replacing their current cloud services with other cloud services or in-house built systems
Source: MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00026
(Data collection)

Section 2 Trends in Explosive AI Progress

AI continues to evolve explosively, with progress being made in the development of large-scale general-purpose Large Language Models, while new technologies are emerging every day, and it is pointed out that this is a field with great potential for technological change. Furthermore, the AI field, which requires huge investments, tends to be led by overseas big tech companies (giant digital companies with global influence) and overseas startups with AI talent and advanced technology that receive huge investments.

Amidst this trend, while Japan's presence in the AI field is not necessarily high on a global scale, domestic companies and organizations are actively engaged in technological development, including model development.

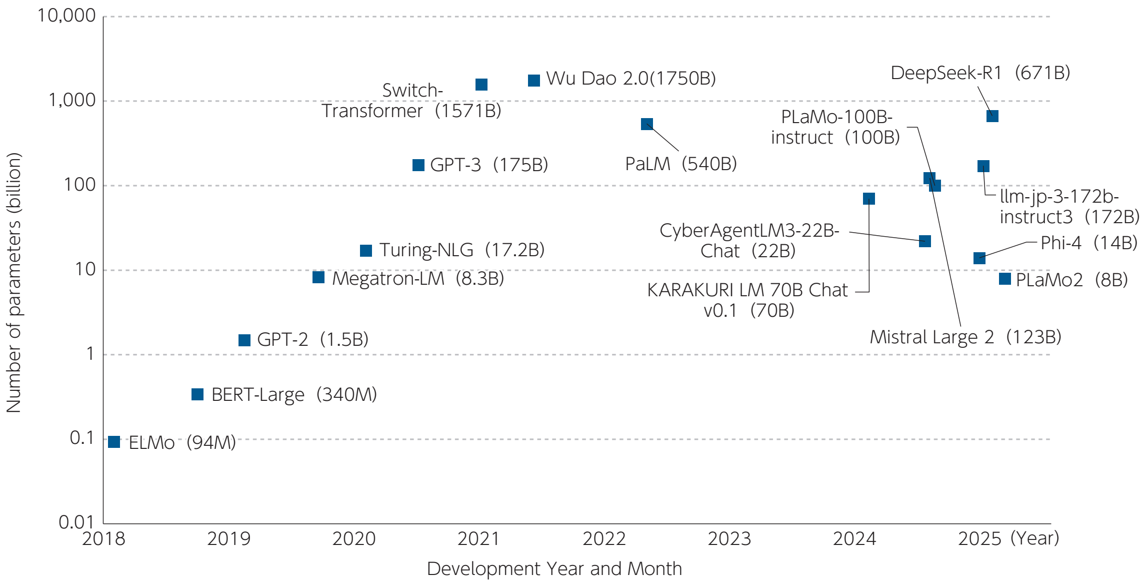
As AI continues to evolve, penetrate and integrate across all digital fields, it is increasingly likely to become a fundamental element underpinning the digital society.

1. Current Status and Trends in AI Technology Development

(1) Intensifying global AI development race

AI comes in many forms, but one of the major trends in recent AI technology development and applications is "generative AI," which generates text, images, videos, etc., and one of the technologies within this is the Large Language Model (LLM), which applies deep learning technology. In 2020, OpenAI proposed the Scaling Law, stating that the performance of LLM improves as the size of the data used for learning, the amount of calculations used for learning, and the number of model parameters increase. For example, while the GPT-2 model announced by OpenAI in 2019 had 1.5 billion parameters, the parameters in GPT-3, announced by the company in 2020, were scaled up to approximately 175 billion, about 120 times larger. The trend toward larger scale has continued since then, with the number of parameters in PaLM announced by Google in April 2022 reaching 540 billion (**Figure 1-1-2-1**).

Figure 1-1-2-1 Changes in the number of Large Language Model (LLM) parameters[1]



(Source) Prepared from the University of Tokyo Matsuo Laboratory "AI Evolution and Japan's Strategy" (2023) and presentation materials by development organizations

Following the Scaling Law, investment in computing resources such as GPU and data centers has intensified, particularly among big tech companies. Furthermore, startups such as OpenAI, Anthropic, and Mistral AI, which have received massive investments from big tech companies and venture capital firms, have also become major players in LLM development and are participating in the development race.

Figure (related data) Investment status of major AI developers
Source: Prepared from related reports and materials
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00028
(Data collection)

[1] This figure does not include models for which the number of parameters has not been published. Note that the number of parameters for recent LLMs is often not disclosed.

(2) Recent trends in AI research and development

The AI field is one where new technologies and models are announced daily, and technological innovation is advancing at a remarkable pace. While it is not possible to describe all of these technological innovations, the major technological trends that have recently emerged will be discussed, focusing on the LLM field.

A LLM research and development trends

(A) Emergence of reasoning models

In September 2024, OpenAI announced the development of the "OpenAI o1" series as a reasoning model for solving difficult problems. o1 outperformed OpenAI's GPT-4o model on numerous evaluation metrics in the fields of science, code generation, and mathematics, areas where conventional generative AI has traditionally struggled. For example, in the U.S. Mathematical Olympiad Preliminary Round, o1 was able to solve approximately 83% of the problems. This is considered to be an academic achievement comparable to the top 500 students in the U.S. o1 also outperformed experts with doctorates in the performance evaluation index of expertise in chemistry, physics, and biology[2]. It was also reported that when the o1 model was used to solve the 2025 University of Tokyo entrance exam questions,[3] it achieved a higher score than the minimum passing score[4].

(B) An open model developed by a Chinese AI startup and its impact on the market

In January 2025, Chinese AI startup DeepSeek announced the development of "DeepSeek-R1." This model is said to achieve performance equivalent to OpenAI's reasoning model "o1" through various technical innovations[5]. DeepSeek-R1 has garnered particular attention for being made openly available to anyone, being developed by an emerging Chinese startup, and its low development cost[6].

Immediately after the announcement of DeepSeek-R1, the stock prices of semiconductor companies and companies that provide AI infrastructure through cloud services, etc. fell, affecting all AI-related stocks. The emergence of DeepSeek-R1, which is said to have achieved both low cost and high performance, may have caused the fall of such stock prices as it cast doubt on the long-held belief that developing high-performance models requires massive investment.

However, developing and operating advanced AI requires more data processing, and if costs further decrease, the number of developers and users is expected to increase, therefore, it is suggested that demand for AI semiconductors will actually increase[7,8].

(C) Development of relatively small language models

While the competition to develop LLMs is intensifying, attention is also being paid to the development of models that are composed of LLMs with relatively fewer parameters. Generally, the more parameters an LLM has, the higher its learning ability. However, due to their large scale, their services are often provided only via cloud services or APIs, which can result in long response times due to the massive amount of computational processing, and the input data may be used as training data by the LLM provider. On the other hand, small scale models are relatively lightweight and capable of fast processing, making them advantageous in environments without network connectivity (local environments) or for specific applications. As a result, their development is being actively pursued.

For example, Microsoft has developed the "Phi" series as a small scale model, and released the 14 billion parameter "Phi-4" in December 2024. Phi-4 is a model capable of complex reasoning, and is said to have outperformed other companies' models of the same size in mathematics competition problems[9].

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[2] OpenAI "Learning to reason with LLMs" <https://openai.com/index/learning-to-reason-with-llms/> (Reference March 11, 2025)

[3] The Common Test for University Admissions and the University of Tokyo Second Stage Examination

[4] Kyodo News (April 5, 2025) "AI Meets the 'Passing Standard' for the University of Tokyo, College of Arts and Sciences, Science III Exams: Exceeds the Minimum Passing Score for 2025 Entrance Exams" <https://nordot.app/1281148575208423464> (Reference April 14, 2025)

[5] DeepSeek-R1 and its predecessor, DeepSeek-V3, are said to have achieved high performance at low cost through various technological innovations. For example, DeepSeek-V3 employs a technique called MoE (Mixture of Experts), which incorporates multiple specialized units (Experts) called upon for each input. To optimize the parallel computation required for this, various innovations were implemented (based on an interview with Okanohara Daisuke, CEO of Preferred Networks).

[6] DeepSeek explains that it costs approximately $5.6 million (approximately 860 million yen) to develop one model. According to development cost calculations by Stanford University, the U.S. Google's "Gemini Ultra" cost $191 million and OpenAI's "GPT-4" cost $78 million, which means an even simple comparison with these costs shows the DeepSeek model was developed at less than one-tenth the cost of the major American companies. It should be noted that the figures cited in the paper may not represent the total cost of the entire development process. While there is debate regarding the development costs, many within the U.S. tech industry view the DeepSeek model as having been developed at a significantly lower cost compared to previous costs. Nikkei "DeepSeek Shock: AI Development Costs "Less Than One-Tenth" Using Open-Source Technology <https://www.nikkei.com/article/DGXZQOGN27CE40X20C25A1000000/> (Reference March 12, 2025)

[7] Based on expert interviews (including Kinoshita Masafumi, Executive Officer, ABEJA, Inc.).

[8] Meta announced plans to invest up to $65 billion in AI-related projects by 2025, while Alphabet, the parent company of the U.S. Google, expects to spend $75 billion on capital expenditures for data centers and AI infrastructure development in 2025. (Bloomberg "Meta Shares Rise, Longest Streak of 12 Consecutive Gains -Market Cap Gains $240 Billion" (February 5, 2025) < https://www.bloomberg.co.jp/news/articles/2025-02-04/SR63J7DWLU6800> (Reference March 18, 2025), Bloomberg "Alphabet shares plummet revenue falls short of expectations -cloud growth slows" (February 5, 2025) < https://www.bloomberg.co.jp/news/articles/2025-02-04/SR6G6DT0AFB400> (From reference March 18, 2025)

[9] Microsoft, "Introducing Phi-4:Microsoft's Newest Small Language Model Specializing in Complex Reasoning" <https://techcommunity.microsoft.com/blog/aiplatformblog/introducing-phi-4-microsoft%E2%80%99s-newest-small-language-model-specializing-in-comple/4357090> (Reference March 16, 2025)

B AI agents

As generative AI advances, services called "AI agents" are becoming more widespread. The definition of an AI agent varies depending on the development company, but recently, it is thought that the term AI agent tends to refer to what has the ability to automatically determine tasks (and subdivide tasks as necessary) and carry out processing in response to set goals or instructions given in natural language.

Since the second half of 2024, many services claiming to be "AI agents" have been developed and launched (**Figure 1-1-2-2**) . Some point out that AI agents themselves are not particularly technologically advanced. [10]However, it is true that advances in LLMs are enabling AI to handle more complex tasks, such as multimodal AI that can process multiple data formats such as text, images, audio, and video in an integrated manner, and reasoning models that are capable of logical thinking. It is expected that more user-friendly services leveraging LLMs and other technologies will emerge in the future.

Figure 1-1-2-2 Service overview and definition of so-called "AI agents"

Company name	Service overview
Microsoft	･Three types of AI agents, including built-in agents integrated into Microsoft 365 Copilot are offered. The built-in agents are embedded in various Microsoft 365 apps and can play the roles of interpreter, facilitator, self-service, project manager, etc.
Salesforce	･In October 2024, the company announced that it would offer the autonomous AI agent "Agentforce" in Japan. Responding to customers in natural language, arranging appointments with prospective customers, coaching sales representatives through role-playing, and assisting with narrowing down customer segments and creating content for campaign development.
Amazon Web Services	･ "Agents for Amazon Bedrock," a service for developing AI agents, is offered. The acquired information can be used to respond to user instructions and tasks. The system also includes enhanced functionality to track the process the AI agent executed to arrive at the final answer after the user entered instructions, as well as enhanced functionality to improve response accuracy.
OpenAI	･In January 2025, the company announced the launch of "Operator," an AI agent service in which the AI performs tasks on behalf of users. When the user inputs the task they want to perform, the AI reads the screen like a screenshot and executes it.
Anthropic	･In October 2024, the company announced the development of "computer use," an AI that operates computers on behalf of people. The screen the user is viewing on their computer is recognized as a screenshot converted into image data, and operations such as moving the cursor, clicking, and entering text can be performed.

Company name	Definition of an AI agent
Microsoft	A system designed to perform specific tasks, answer questions, and automate a series of processes on behalf of a user[11].
Salesforce	An intelligent system that can understand and respond to user inquiries without human intervention[12].
Amazon Web Services	A software program that interacts with its environment, collects data, and uses that data to perform self-determined tasks to achieve predetermined goals. Humans set the goals, but the AI agent independently chooses the optimal actions it needs to take to achieve them[13].

(Note) As this information is based on materials from each company at the time of announcement, it may differ from the current service content and definitions.

(Source) Prepared from reference materials from each company and related reports[14]

[10] Based on an interview with Professor Satoshi Kurihara of Keio University.
[11] Microsoft "What is an AI Agent?" <https://learn.microsoft.com/ja-jp/azure/cosmos-db/ai-agents> (Reference March 13, 2025)
[12] Salesforce "What is an AI Agent – The Complete Guide" <https://www.salesforce.com/jp/agentforce/what-are-ai-agents/> (Reference March 13, 2025)
[13] Amazon "What is an AI Agent?" <https://aws.amazon.com/jp/what-is/ai-agents/> (Reference March 13, 2025)
[14] Microsoft, "Operational Efficiency and Innovation Enabled by AI Agents: Latest Case Studies from Japan" (December 18, 2024 <https://news.microsoft.com/ja-jp/2024/12/18/241218-operational-efficiency-and-innovation-enabled-by-ai-agents-latest-case-studies-from-japan/> (Reference March 18, 2025), NIKKEI X Tech, "MS Announces Genuine AI Agent, CEO Nadella Aims for an 'Agentic World'" (November 20, 2024) https://xtech.nikkei.com/atcl/nxt/column/18/03012/112000001/ (Reference March 18, 2025), Salesforce "Agentforce" <https://www.salesforce.com/jp/agentforce/> (Reference March 17, 2025), NTT EAST "Explanation of AI Agents and Amazon Bedrock Agents" (March 12, 2025) <https://business.ntt-east.co.jp/content/cloudsolution/column-578.html> (Reference March 18, 2025), NIKKEI X Tech "AWS, Google, and MS's AI Agent Development Services Enable Building AI Agents without Coding" (October 10, 2024) <https://xtech.nikkei.com/atcl/nxt/column/18/02968/100100003/> (Reference March 18, 2025), NIKKEI X Tech "Open AI has Announces its AI agent "Operator," which Executes User-Directed Tasks Using its Own Custom Browser" <https://xtech.nikkei.com/atcl/nxt/news/24/02098/> (Reference March 17, 2025), NIKKEI "AI Developed by Anthropic in the U.S. to Operate Computers on Behalf of Humans" (October 23, 2024) https://www.nikkei.com/nkd/company/us/CRM/news/?DisplayType=1&ng=DGXZQOGN22DYL022102024000000 (Reference March 17, 2025), Bloomberg "Anthropic Reveals New AI Tool, Making the Experience More Intuitive" (October 23, 2024) https://www.bloomberg.co.jp/news/articles/2024-10-23/SLS7T9T0AFB400 (Reference March 17, 2025)

C AI Robotics

Competition for development and investment in the field of AI robotics, which applies AI technology to robotics, is heating up. The background to this is that dramatic innovations in image recognition and natural language processing in the field of AI have made flexible and complex processing possible, and robots are expected to replace labor in developed countries overseas where there are concerns about labor shortages due to declining birthrates and aging populations.

For example, as one area of such trend, the development of humanoid robots has recently become active. There is no clear definition of a humanoid robot, but it is generally modeled after the shape and capabilities of a human, and is designed to handle a wide range of tasks, from use in factories, such as grasping objects and arranging parts, to tasks intended for use in the home, such as folding laundry. Because humanoid robots have a human-like shape, they are thought to be easily introduced into human-centered social infrastructure, and it is expected that in the future they will be able to assist or replace human tasks[15].

Against this backdrop, the race to develop humanoid robots for commercialization is heating up, particularly in the U.S. and China. Currently, humanoid robots are being developed for pilot deployment in manufacturing sites and factories and for industrial use, but some companies are aiming to create humanoid robots that can be used in everyday life, such as for household chores and entertainment in the long run. It is expected that research and development into highly versatile robots will continue in the future **(Figure 1-1-2-3)**.

Figure 1-1-2-3 Humanoid robot development examples

Company name/Model name	Characteristics/Direction
Tesla (U.S.) Optimus	･In October 2024, the company unveiled the humanoid robot "Optimus." ･In addition to industrial use, the robot can also be used for everyday purposes such as household chores and entertainment. ･The company plans to produce small quantities for its own factories in 2025, and mass-produce for other companies in 2026.
Figure AI (U.S.) Figure 02	･In August 2024, the company announced its new humanoid robot, "Figure 02." ･In partnership with Open AI, the humanoid robot incorporates a voice recognition system that can have natural conversations with humans. ･A pilot introduction of the humanoid robot was conducted at a BMW plant. ･The company aims to alleviate labor shortages and improve industrial efficiency, while also considering developing a consumer version.
Agility Robotics (U.S.) Digit	･In March 2023, the company announced the next generation model of the bipedal multipurpose robot "Digit." ･Designed to work with humans in logistics facilities such as warehouses.
Boston Dynamics (U.S.) Atlas	･In April 2024, the company announced the fully electric robot "Atlas" as the successor to its previous hydraulic model "HD Atlas." Compared with conventional hydraulic models, the new robot has a wider range of motion. ･In 2025, a pilot introduction of the new robot will be conducted at an automobile manufacturing plant, with the aim of using it in the industrial sector.
Unitree Robotics (China) G1	･In May 2024, the company announced the bipedal humanoid robot "G1." It features a balancing system that allows it to continue walking without falling over even when pushed by a person, and a joint mechanism with a wide range of motion. ･The price starts at $16,000 (approximately 2.5 million yen), making it a low-cost option that will encourage social implementation.
Pudu Robotics (China) PUDU D9	･In December 2024, the company announced its first bipedal humanoid robot, "PUDU D9." It walks on two legs at the same speed as an adult, 2m/s, and can handle a variety of terrain, including stairs, slopes, and uneven ground.

(Source) Prepared from reference materials[16]

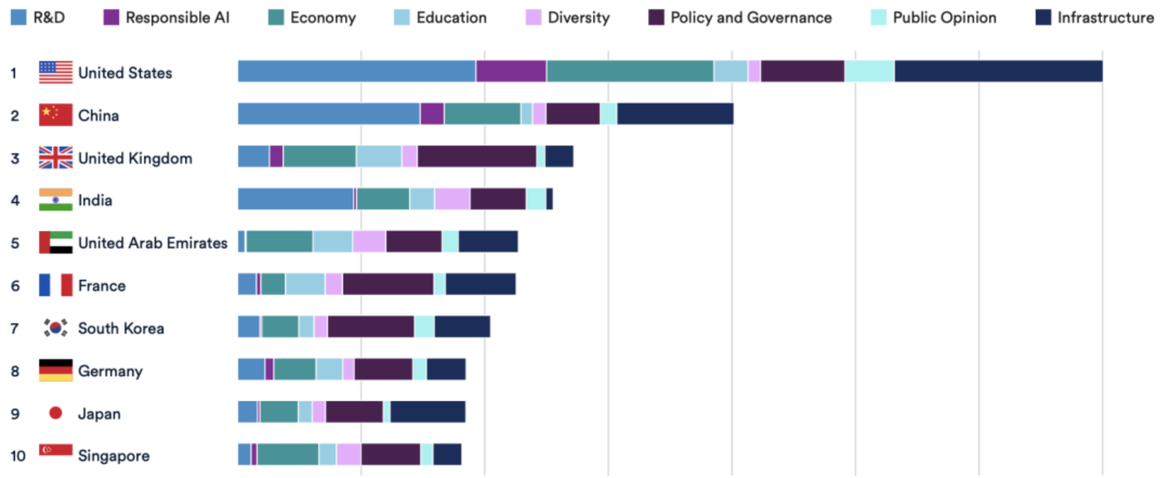
[15] Mitsui & Co. Global Strategic Studies Institute "Humanoid Robots - Technological Advancement Driven by Generative AI and the Beginning of Pilot Introduction" <https://www.mitsui.com/mgssi/ja/report/detail/__icsFiles/afieldfile/2025/02/07/2501btf_tsuji_matsuura.pdf> (Reference March 19, 2025)

[16] NIKKEI "Tesla Unveils Humanoid Robot Performing Household Chores and Other Everyday Tasks" (October 11, 2024) https://www.nikkei.com/article/DGXZQOGN114AB0R11C24A0000000/ (Reference March 19, 2025), Ledge.ai "Figure, in Partnership with Open AI, Unveils New Humanoid Robot "Figure 02" and Successfully Tests with BMW for Practical Use in Automotive Manufacturing" (August 11, 2024) <https://ledge.ai/articles/figure02>, CNET Japan "Revamps Ability Robotics, Bipedal Robot "Digit" (April 4, 2023) <https://japan.cnet.com/article/35202097/> (Reference March 19, 2025), NIKKEI X Tech "Interview with Boston Dynamics, Humanoid Robots, Starting as Automobile Plant Workers" (March 19, 2025) https://xtech.nikkei.com/atcl/nxt/column/18/03118/00004/ (reference March 19, 2025), NIKKEI X Tech "Where are Bipedal Humanoid Robots Headed? AI Advancement are Reaccelerating the Development Race among Overseas Companies" (July 31, 2024) <https://xtech.nikkei.com/atcl/nxt/mag/nmc/18/00011/00263/?P=3> (Reference March 19, 2025), NIKKEI X Tech "Lower Prices Drive Social Implementation, Developing a Wide Range of Applications from Factories to Homes" (January 31, 2025) <https://xtech.nikkei.com/atcl/nxt/mag/nmc/18/00163/00004/?P=3> (Reference March 19, 2025), Unitree <https://www.unitree.com/g1> (Reference March 19, 2025), PRTIMES "PUDU Unveils its First Full-sized Humanoid Robot "PUDU D9" (December 20, 2024) <https://prtimes.jp/main/html/rd/p/000000051.000087027.html>

(3) Trends in AI development and business expansion in Japan

Looking at various evaluation reports on AI, it cannot be said that Japan is highly rated compared with other world-leading countries in terms of its AI research and development capabilities and utilization of AI. For example, according to the 2023 Global AI vibrancy ranking released by Stanford University's HAI (Human-Centered Artificial Intelligence) in November 2024, Japan is ranked 9th overall, lagging behind countries such as the U.S., China, and the UK **(Figure 1-1-2-4)**. In addition, in AIRankings, which ranks AI research capabilities based on factors such as the number of papers on AI, the top countries in recent years have been the U.S., China, the UK, and Germany, in that order, with Japan hovering around 11th or 12th place. However, Japanese companies and organizations are also taking various steps toward AI development.

Figure 1-1-2-4 Global AI vibrancy ranking: top ten countries (2023)



(Source) Stanford University Human-Centered Artificial Intelligence(2024) "Global AI Vibrancy Tool" [17]

Figure (related data) Changes of AI rankings by country
Source: Prepared based on AIRankings (data obtained on February 25, 2025)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00032
(Data collection)

A LLM research and development trends

While overseas big tech companies and AI startups are globally leading the development of LLMs, Japanese organizations are also working on developing LLMs. Compared with the world's most cutting-edge models, Japanese models tend to be relatively small-scale. In addition, in recent years, development has also progressed on relatively small-scale yet high-performance models **(Figure 1-1-2-5)**.

[17] Stanford University "Global AI Vibrancy Tool" <https://hai.stanford.edu/ai-index/global- vibrancy-tool> (Reference March 14, 2025)

Figure 1-1-2-5 Examples of LLM development by Japanese organizations

Development organization: Model name (number of parameters)	Announcement date	Overview
Tokyo Institute of Technology (currently Institute of Science Tokyo),, Tohoku University, Fujitsu Limited, RIKEN, Nagoya University, CyberAgent Inc., Kotoba Technologies Inc.: Fugaku-LLM (about 13 billion)	May 2024	Learning is done using the supercomputer "Fugaku." Improved Japanese performance by having Fugaku learn original data from scratch. Demonstrated high performance in an evaluation index for Japanese, particularly well in humanities and social science tasks. Excellent in terms of transparency and security as the entire learning process can be monitored[18].
CyberAgent: CyberAgentLM3-22B-Chat (about 22.5 billion)	July 2024	The model was developed without being based on any existing models. Its Japanese proficiency is on par with Meta's model "Meta-Llama-3-70B Instruct[19]."
Fujitsu and Cohere Inc: Takane (unknown number of parameters)	September 2024	This model was developed based on the LLM from Canadian AI startup Cohere and can be used for highly specialized tasks. This LLM achieved the world's highest record in terms of the Japanese language performance evaluation index (at that time). This model can be used in a secure private environment[20].
National Institute of Advanced Industrial Science and Technology and Institute of Science Tokyo (A research team led by Professors Okazaki Naoaki and Yokota Rio): Llama 3.1 Swallow (about 8 billion/ about 70 billion)	October 2024	While maintaining the capabilities of a large language model (Meta's Llama 3.1) with high English proficiency, the model succeeded in improving Japanese language understanding, generation, and dialogue capabilities[21].
Preferred Networks Group[22]: PLaMo-100B (about 100 billion)	October 2024[23]	It was developed from scratch with proprietary architecture and training data. It achieved high Japanese language performance by surpassing OpenAI's GPT-4o and others in a Japanese language performance benchmark (Later, "PLaMo2 1B" and "PLaMo2 8B" were developed with the number of parameters reduced)[24].
National Institute of Informatics llm-jp-3-172b-instruct3 (about 172 billion)	December 2024	Trained a large language model with about 172 billion parameters (the same scale as GPT-3) from scratch at the institute's Research and Development Center for Large Language Models and made it available to the public[25].

* Model descriptions are those at the time the press releases were published and models were released by each organization.

(Source) Prepared from published materials of each development organization

The government support measures are supporting such LLM development originating in Japan.

For example, the "GENIAC" project, launched by the METI and the New Energy and Industrial Technology Development Organization (NEDO), supports the provision of computing resources necessary for the development of foundation models. In the first phase (development period for providing computing resources: February to August 2024), the project worked on the development of foundation models for a total of 10 development themes. The second phase began in October 2024, with development of foundation models underway for a total of 20 development themes.

Additionally, in order to strengthen AI development capabilities, the Ministry of Internal Affairs and Communications (MIC) is leading efforts, through the National Institute of Information and Communications Technology (NICT), to develop and expand the large amount of high-quality training data, primarily in Japanese, required for LLM development, and provide it to Japanese LLM developers[26].

Furthermore, the Ministry of Education, Culture, Sports, Science and Technology is leading efforts, through the Inter-University Research Institute Corporation/Research Organization of Information and Systems/National Institute of Informatics (NII), to conduct research and development contributing to the transparency and reliability of generative AI. It is also working to share the knowledge and experience gained through a study group (LLM-jp) that brings together AI researchers and engineers from industry and academia, centered around the NII, in an effort to contribute to fostering research and development capabilities related to generative AI in Japan.

18 Fujitsu "Release of 'Fugaku-LLM' – a large language model trained on the supercomputer 'Fugaku'"<https://pr.fujitsu.com/jp/news/2024/05/10.html> (Reference March 17, 2025)
19 CyberAgent "publicly releases version 3 of its proprietary Japanese LLM (Large Language Model) - Providing a commercially available model with 22.5 billion parameters" <https://www.cyberagent.co.jp/news/detail/id=30463> (Reference March 17, 2025)
20 Fujitsu "launches 'Takane' - A large language model for enterprises offering the highest Japanese language proficiency in the world" <https://pr.fujitsu.com/jp/news/2024/09/30.html> (Reference March 17, 2025)
21 National Institute of Advanced Industrial Science and Technology "releases 'Llama 3.1 Swallow' by improving the Japanese language capabilities of the open source LLM" <https://www.aist.go.jp/aist_j/press_release/pr2024/pr20241008_2/pr20241008_2.html> (Reference March 17, 2025)
22 Developed by Preferred Elements, a 100%-owned subsidiary of Preferred Networks
23 Release date of PLaMo-100B-Pretrained<https://www.preferred.jp/ja/news/pr20241015/>. Note that PLaMo-100B-Instruct was announced in August 2024<https://tech.preferred.jp/ja/blog/plamo-100b-post-training/>
24 Preferred Networks "releases PlaMo-100B-Pretrained, a Large Language Model as a result of developing the first cycle of GENIAC" (October 15, 2024) <https://www.preferred.jp/ja/news/pr20241015/ > (Reference March 17, 2025)
25 National Institute of Informatics "publicly releases 'llm-jp-172b-instruct3,' a fully open large language model with about 172 billion parameters (GPT-3 level)" <https://www.nii.ac.jp/news/release/2024/1224.html> (Reference March 17, 2025)
26 NICT is using the language data it has built for learning to prototype an LLM with up to 311 billion parameters.

B Trends in AI robotics research and development and social implementation

The U.S. and China are particularly ahead in the research, development, and social implementation of humanoid robots, but in Japan, research and development in the field of AI robotics (including collaboration between AI and robots) is also being conducted by industry and academia, and efforts are also underway toward social implementation. Here are some examples.

(A) Development of a robot foundation model by the AI Robot Association[27]

In December 2024, the AI Robot Association (AIRoA), a general incorporated association, was established with the aim of building a robot data ecosystem through the fusion of AI and robots. As AI technology evolves, there is a growing need for foundation models capable of integrating large amounts of data and learning efficiently, even in the field of robotics. However, it has been pointed out that the current market does not have a fully developed framework for sharing and utilizing large amounts of data, and that development efficiency remains difficult to improve as each company and research institution handles data separately. AIRoA promotes open, large-scale data collection across industry boundaries and the development and publication of foundation models, with the aim of building a scalable robot data ecosystem to realize advanced general-purpose robots.

(B) Social experiment using the guide robot "ugo" and generative AI developed by NTT

A social experiment using the guide robot 'ugo' developed by ugo, Inc. that provides autonomous mobile business robots, and several generative AI models, including the NTT-developed LLM "tsuzumi," began in January 2025 by Osaka Metro, NTT WEST Group, NTT Communications[28], and ugo, Inc., in anticipation of an increase in tourists from Japan and abroad visiting EXPO 2025 Osaka, Kansai. The experiment explores ways to improve the ability to respond quickly to questions in multiple languages **(Figure 1-1-2-6)**.

Figure 1-1-2-6 Social experiment using multilingual guide robot "ugo" and generative AI "tsuzumi," etc.

(Source) NTT WEST, Inc.[29]

C Trends in AI agent development and business expansion

Japanese companies are also making moves regarding AI agents.

For example, in February 2025, SoftBank Group Corp. and OpenAI announced a partnership to develop and sell "Cristal intelligence," a cutting-edge AI for businesses. The partnership will see SoftBank and OpenAI exclusively sell "Cristal intelligence," which has AI agent functions, to major Japanese companies[30]. SoftBank Group will jointly develop AI agents with OpenAI, and plans to operate its AI data center in Japan.[31,32]

Fujitsu has also developed and begun offering globally an AI service called "Fujitsu Kozuchi AI Agent" that enables AI to autonomously and collaboratively handle highly challenging tasks.[33]

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27 NIKKEI X Tech, "Toyota and other major companies join forces to start building a 'robot foundation model' originating in Japan" (March 12, 2025) <https://xtech.nikkei.com/atcl/nxt/column/18/03118/00001/> (Reference March 21, 2025)
28 NTT Communications changed its company name to "NTTDOCOMO BUSINESS, Inc." as of July 1, 2025
29 Osaka Metro, NTT WEST Group, NTT Communications, ugo inc. "A social experiment will be conducted at Umeda Station on the Osaka Metro Midosuji Line, using the multilingual guide robot "ugo" and the generative AI "tsuzumi." <https://www.ntt-west.co.jp/news/2501/250108a.html>
30 SoftBank News: "OpenAI and SoftBank Group go into partnership. "Crystal intelligence," a cutting-edge AI for businesses, will be offered in Japan, ahead of the rest of the world" (February 5, 2025) <https://www.softbank.jp/sbnews/entry/20250204_02> (Reference March 26, 2025)
31 Nikkei "SoftBank, OpenAI to run autonomous AI agents at former Sharp Sakai plant" (March 14, 2025) <https://www.nikkei.com/article/DGXZQOUC12A7X0S5A310C2000000/> (Reference March 10, 2025)
32 OpenAI announced the "Stargate Project," which plans to invest $500 billion (approximately 78 trillion yen) over four years from 2025 to build a new AI infrastructure for OpenAI in the U.S. SoftBank is among the initial investors. (Open AI "Announcing the Stargate Project" <https://openai.com/ja-JP/index/announcing-the-stargate-project/> (Reference March 15, 2025)
33 Fujitsu "Began offering "Fujitsu Kozuchi AI Agent" in which AI autonomously collaborates with humans to promote advanced business processes" (October 23, 2024)
<https://www.nikkei.com/article/DGXZRSP680645_T21C24A0000000/?msockid=32429ef1e23f674838988bb8e35b6633> (Reference March 10, 2025)

2. Current status of AI use

(1) Current status of AI use among individuals

In order to understand the current state of AI use among individuals, a survey was conducted targeting the general public (hereinafter referred to as the "FY2024 survey").

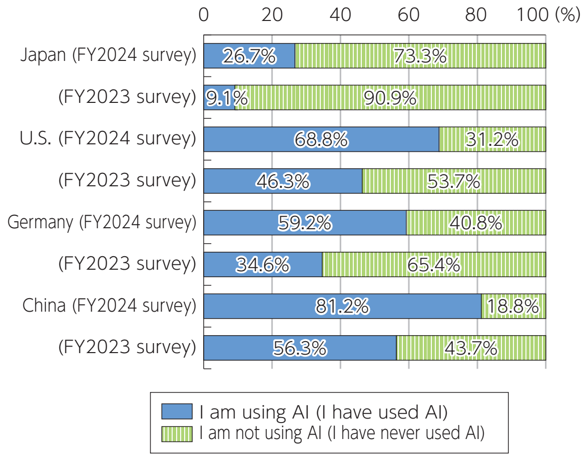
In Japan, the percentage of respondents who answered that they "use (or have used in the past)" some kind of generative AI service was 26.7% in the FY2024 survey. Considering that the percentage of those who answered "I use generative AI (or have used it in the past)" was 9.1% in a survey conducted in FY2023 (hereinafter referred to as the "FY2023 survey"), usage has been expanding (**Figure 1-1-2-7**) . In addition, looking at the age groups, 44.7% of people in their 20s responded that they had used AI services in the FY2024 survey (**Figure 1-1-2-8**) .

Similar surveys were also conducted in the U.S., Germany, and China, and AI use is expanding in each of these three countries (the percentage of people who have experience using generative AI increased from 46.3% in the FY2023 survey to 68.8% in the FY2024 survey in the U.S., from 34.6% to 59.2% in Germany, and from 56.3% to 81.2% in China).

In Japan, when people who answered that they "do not use (have never used)" text generation AI services were asked about the reasons for not using them, the most common response was "not necessary for my life or work," followed by "I don't know how to use it," suggesting that the barriers to use are still high. Many also responded that there were "no attractive services" (**Figure 1-1-2-9**) .

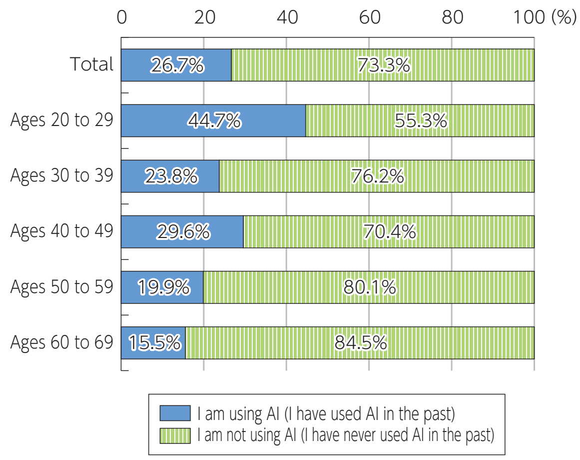
Additionally, when asked about their intention to use AI (including generative AI), there was a relatively high intention to use it for research and content summarization and translation, a trend similar to that seen in the FY2023 survey (**Figure 1-1-2-10**) .

Figure 1-1-2-7 Experience using generative AI services (by country)



(Source) MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"

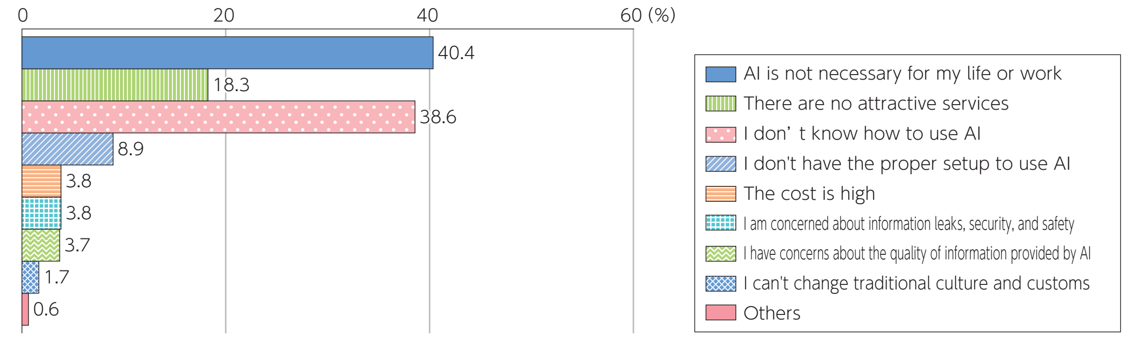
Figure 1-1-2-8 Experience using generative AI services (by age group, Japan)



(Source) MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"

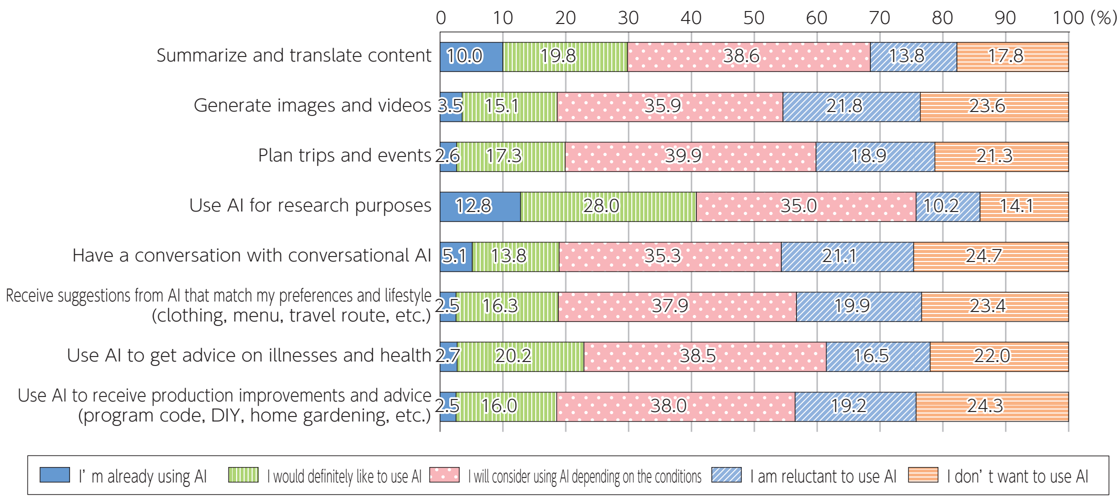
Figure (related data) Experience using each generative AI service (Japan, by age group)
Source: MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00037
(Data collection)

Figure 1-1-2-9　Reasons for not using text generation AI services



(Source) MIC (2025) “Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries”

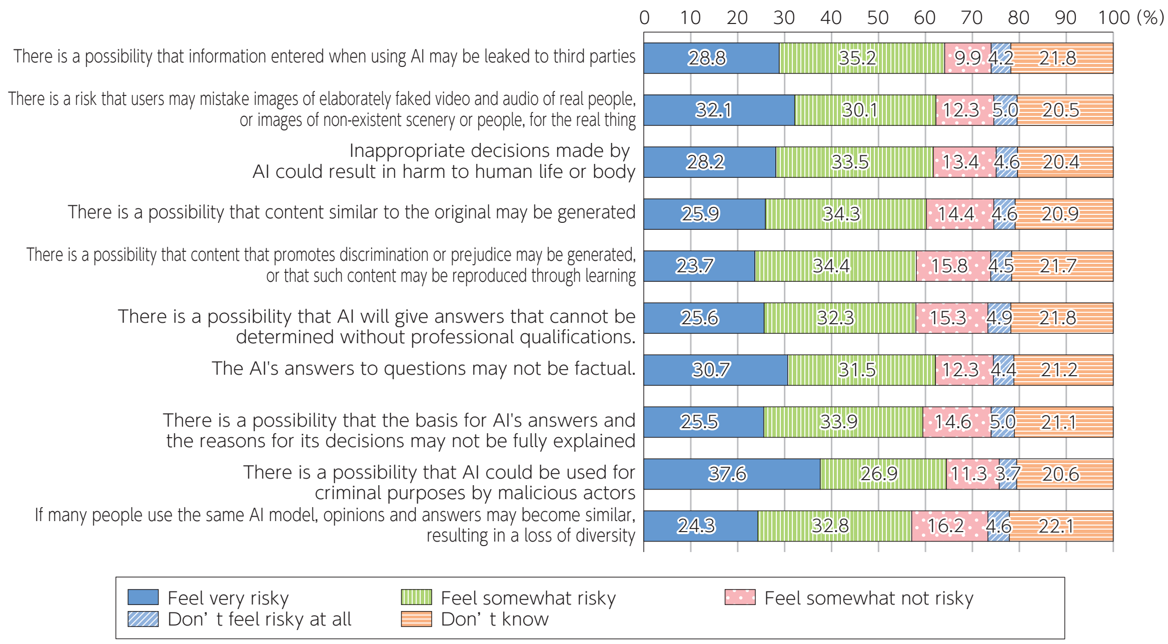
Figure 1-1-2-10　Intention to use generative AI and AI



(Source) MIC (2025) “Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries”

In a survey of people’s awareness of the risks of using AI, the number of respondents who said that “I feel it is very risky” was relatively high for such reasons as criminal use by malicious actors, being deceived by elaborate fakes, and the possibility that AI’s answers to questions may not be factual (**Figure 1-1-2-11**).

Figure 1-1-2-11　Perspective on the risks of AI use



(Source) MIC (2025) “Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries”

Figure (related data) Intention to use generative AI and AI (by country)
Source: MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00041
(Data collection)

Figure (related data) Perspective on the risks of AI use (by country)
Source: MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00042
(Data collection)

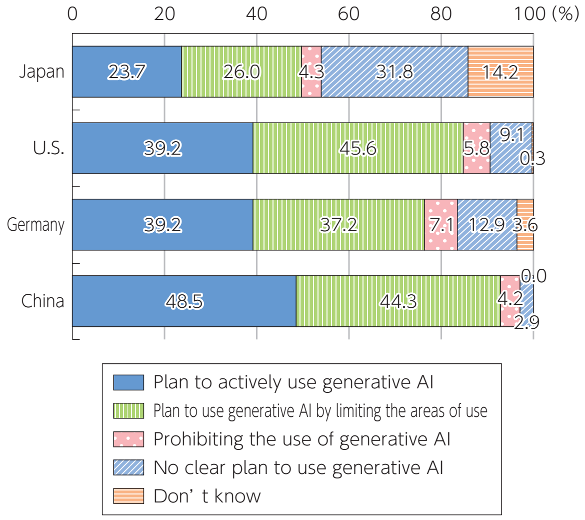
(2) Current status of AI use among companies

Based on a survey conducted in four countries, namely Japan, the U.S., Germany, and China, the current status of AI use in companies is summarized.

Respondents were asked about the policy for using generative AI at their companies, the percentage of companies in Japan that formulate a policy of "positively using generative AI" or "limiting domains for using generative AI" was 49.7% in the FY 2024 survey, an increase from the FY2023 survey (42.7%). On the other hand, compared with other countries surveyed this time, Japan continues to show a lower tendency to use generative AI than other countries (**Figure 1-1-2-12**) .

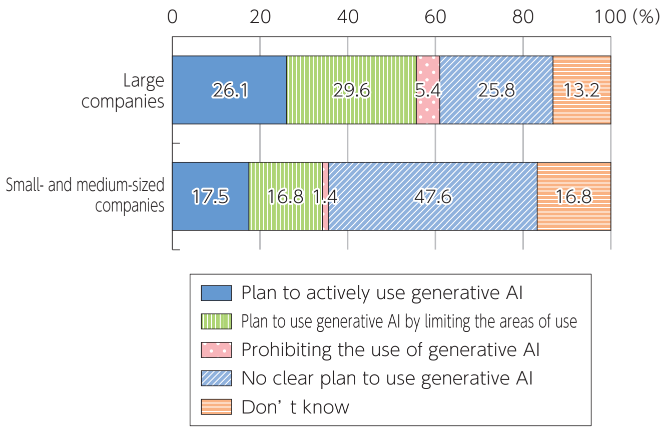
In addition, when looking at the situation in Japan by company size, the majority of small and medium-sized companies responded that they have "not clearly formulated a policy for using generative AI," accounting for about half of the total. The survey indicates that Japanese small and medium-sized companies are lagging behind large companies in deciding on a policy of using generative AI (**Figure 1-1-2-13**) .

Figure 1-1-2-12 Status of policy formulation for using generative AI (by country)



(Source) MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"

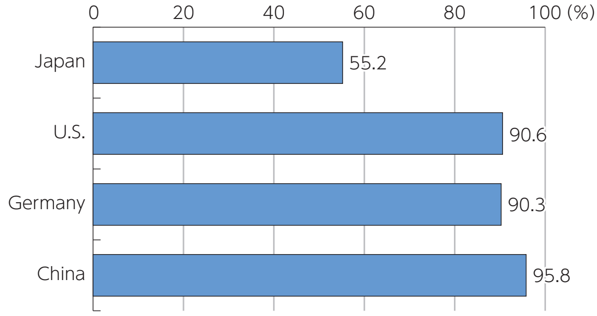
Figure 1-1-2-13 Status of policy formulation for using generative AI (by company size (Japan))



(Source) MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"

Furthermore, when asked about the current status of using generative AI for business areas where it is expected to be used, the percentage of respondents in Japan who answered that they are using generative AI for some kind of business was 55.2% (the percentage who answered "currently using generative AI for business") **(Figure 1-1-2-14)**. For example, regarding individual tasks, 47.3% of respondents in Japan (those who answered "currently using generative AI for business") said they use generative AI to "assist with emails, minutes, document preparation, etc.[34]" Both percentages are low compared with other countries.

Figure 1-1-2-14 Percentage of using generative AI for business in companies (by country)[35]



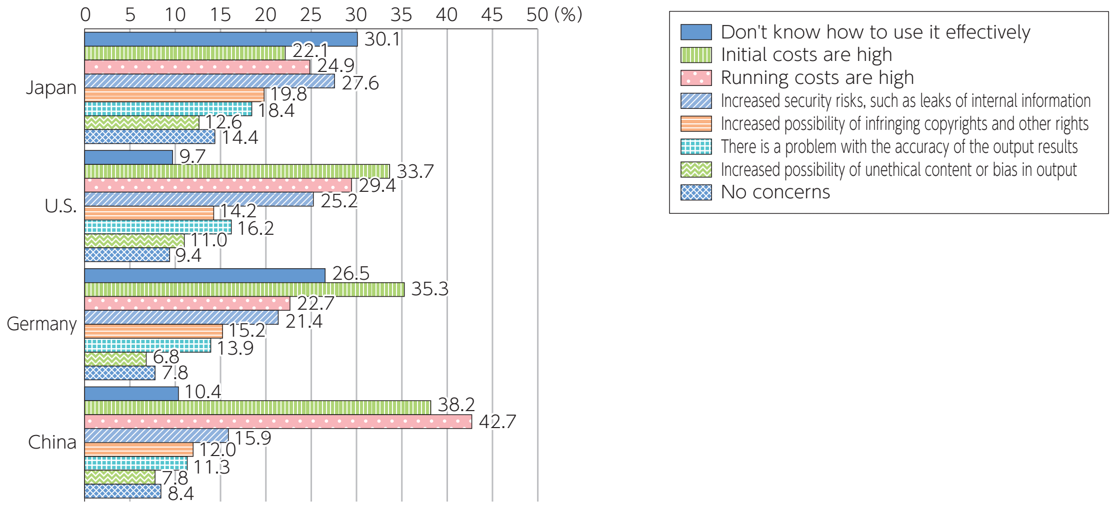
(Source) MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"

Figure (related data) Percentage of using generative AI for business in companies (by business, by country)
Source: MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00046
(Data collection)

When respondents were asked about concerns about introducing generative AI, the most common answer in Japan was "I don't know how to use it effectively," followed by "security risks such as leaks of internal information," "high running costs," and "high initial costs" **(Figure 1-1-2-15)** .

When respondents were asked about their thoughts on the impact that promoting the use of generative AI will have on their company, the most common answer in Japan was that it will "improve business efficiency and alleviate labor shortage." In the other three countries, respondents tend to cite business expansion, acquiring new customers, and new innovations. Overall, all four countries appear to be focusing on the positive aspects of generative AI, such as increased operational efficiency and business expansion, rather than the negative aspects, such as increased security risks **(Figure 1-1-2-16)**.

Figure 1-1-2-15 Concerns about introducing generative AI (by country)

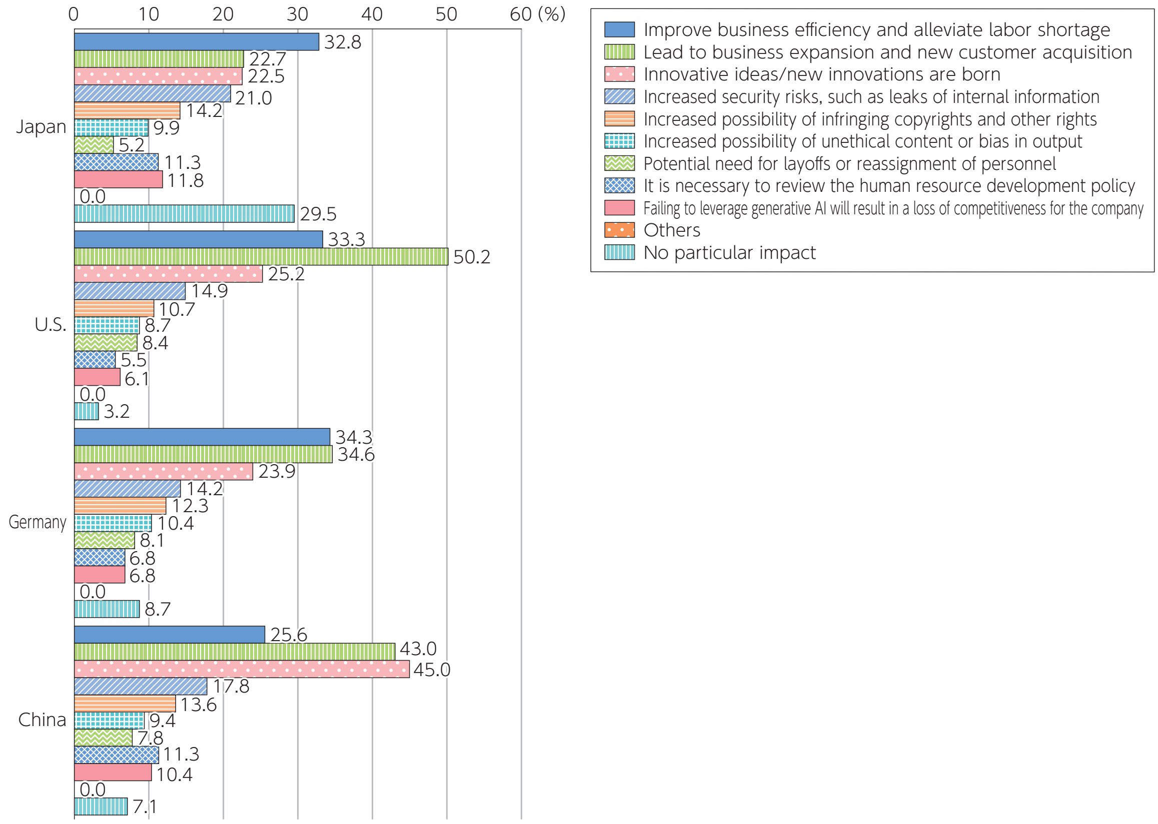


(Source) MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"

[34] Regarding the percentage of using generative AI for each individual task within a company, as the estimation method used for the FY2024 survey was changed from that of the FY2023 survey to improve estimation accuracy, a simple comparison between the FY2024 survey and the FY2023 survey is not possible.

[35] Estimated based on the percentage of respondents who know their company's policy of using AI and answered that they use generative AI for some kind of business.

Figure 1-1-2-16 Effects and impacts of using generative AI (by country)



(Source) MIC (2025) "Survey on the latest trends in ICT, R&D, and digital utilization in Japan and other countries"

Section 3 Foreign Business Operators' Rise in the Digital Field and the Relevant Current Situation in Japan

Overseas platform operators have grown significantly by taking advantage of the characteristics that are easily manifested in digital markets, the data they collect, and the enormous profits, and they have a strong presence in Japan as well. They have expanded from their traditional business fields into other digital fields, and recently their influence has expanded to include physical infrastructure such as submarine cables and power plants.

On the other hand, the share of Japanese companies in the global digital market remains low overall, and the deficit in the balance of international payments in the digital field is on the rise due to factors such as the increasing use of digital technologies in social life and corporate activities in Japan and the low international competitiveness of Japan's digital industry.

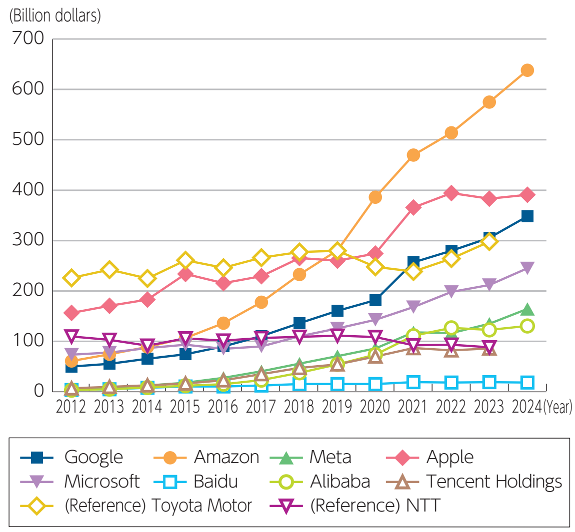
At present, using the excellent digital services available on the market has positive aspects, such as accelerating digitalization. However, if Japan's international competitiveness in the digital field remains low and its dependence on foreign business operators in key digital fields continues to grow, it is pointed out that there are concerns that Japan will lose the opportunity to incorporate the benefits of the rapidly growing digital field into its economic growth, as well as concerns from the perspective of economic security and other aspects.

1. Rise of Overseas Big Tech Companies

(1) Growth of platform operators and its background

Big tech companies, including overseas digital platform operators, have a great presence in providing SNS, cloud services, and other services that are forming the new digital infrastructure of society. These overseas businesses have grown rapidly by taking advantage of various characteristics that are easily manifested in the digital market, as well as the data they collect and the enormous profits. For example, digital platform operators, primarily Google, Apple, Facebook (Meta), Amazon, and Microsoft, have grown to boast world-class levels of both sales and market capitalization (**Figure 1-1-3-1**) [1].

Figure 1-1-3-1 Trends in sales of foreign platform operators



(Source) Prepared from Statista data and the financial information of each company

The rise of giant digital platform operators is driven by characteristics that can be explained by various economic concepts, such as the "network effect," where the value of a service increases as the number of users increases; the "low marginal cost" of providing additional services in comparison to huge fixed costs and the resulting "economies of scale;" and the "lock-in effect," where users find it difficult to switch from a familiar service to another service. These characteristics are not inherent to digital goods alone, but they are more likely to manifest in the digital market, and the market structure makes it easier for businesses that take the lead in the market by using mechanisms that effectively utilize these characteristics to establish an overwhelming competitive advantage.

[1] For the top 15 companies by market capitalization in the global ICT market, see "Market trends" in Section 6 (1), Chapter 1, Part II

(2) Growing influence of big tech companies across fields

Big tech companies are expanding their influence across all layers of the digital industry through technological innovation and market expansion, operating across multiple fields. These companies initially started out by providing applications and services for users, and have gradually expanded and become more involved in the physical infrastructure layer. Today, big tech companies are strengthening their influence across many areas, from digital industries such as cloud services, data centers, and communications infrastructure to power infrastructure, and are also taking the lead in new technological innovations such as generative AI.

Here, the approaches of big tech companies to the network infrastructure layer, energy supply layer, and generative AI, which are areas where new movements by such companies have been particularly significant in recent years, will be discussed.

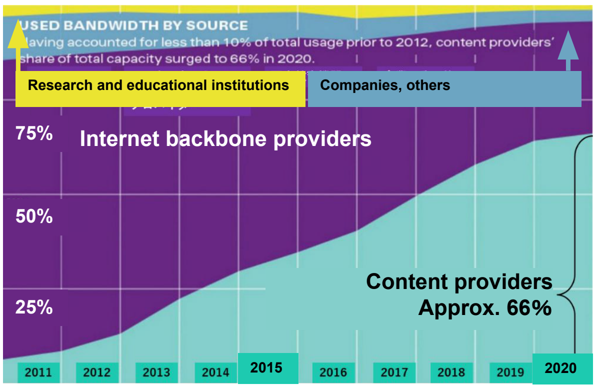
A Network infrastructure layer

Big tech companies have begun investing in communications infrastructure to improve the efficiency of data transmission, etc. Particularly noteworthy is the investment in submarine cables. In order to improve the efficiency of its communications infrastructure and reduce costs, Google laid its own submarine cables and established a high-speed communications network between its data centers. Meta, Microsoft, and Amazon are also participating in the construction of submarine cables[2]. This allows big tech companies to boost intercontinental data transfer speeds, improve the quality of their services and strengthen their influence in the communications infrastructure market.

Until the early 2010s, the laying and use of submarine cables was dominated by telecommunications carriers (Internet backbone providers), and in 2011, content providers[3] accounted for less than 10% of the submarine cable bandwidth use. However, since the late 2010s, big tech companies such as Google, Meta, Microsoft, and Amazon have expanded their installation and use of submarine cables, and in 2020, content providers accounted for nearly 70% of the submarine cable bandwidth use **(Figure 1-1-3-2)** .

With submarine cables carrying 99% of international communications, big tech companies are exerting a major presence in submarine cable investment, changing the traditional telecommunications carrier-led market structure.

Figure 1-1-3-2 Changes in submarine cable bandwidth use



(Source) Prepared based on TeleGeography "A Complete List of Content Providers' Submarine Cable Holdings"

B Energy supply layer

Operating a data center requires a huge amount of electricity, and a stable power supply is essential for the business of big tech companies. As demand for generative AI increases in the future, it is expected that demand for electricity will also increase. With the aim of increasing the stability and cost-effectiveness of energy supplies and the use of renewable energy, some big tech companies are stepping up their involvement through contracts and investments in power plants. For example, Google signed contracts for solar power plants being developed at over 800 locations across Japan[4].

C Leading the field of generative AI

Big tech companies are leveraging their enormous financial resources, advanced technological development

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[2] DIAMOND Online "Major telecommunications companies fall, Google and Facebook take center stage, shifting the driving force behind submarine cable laying" (October 5, 2022) (https://diamond.jp/articles/-/310530)

[3] "Content providers" here refers to networks known as hyperscalers, over-the-top providers, Internet content providers, cloud service providers, etc., including Internet-based content and platform providers (e.g., Google, Meta, Microsoft, Apple), cloud service/platform providers (e.g., Amazon, Microsoft, Oracle, Alibaba, Google), and content delivery networks (CDNs) (e.g., Akamai, CloudFlare).

[4] MIC/METI Expert Group Meetings on Development of Digital Infrastructures (e.g., DCs) (7th) materials "The environment and challenges surrounding Japan's digital infrastructure" (May 30, 2024) (https://www.meti.go.jp/policy/mono_info_service/joho/conference/digital_infrastructure/0007/007_widepj.pdf)

capabilities, world-class human resources, and the vast amounts of data they accumulate every day to establish an overwhelming lead in the field of generative AI and maintain competitiveness. This competitiveness is supported by the multi-layered foundations that these companies have built, creating advantages that cannot be easily emulated.

Regarding the status of LLM development by big tech companies and the social implementation of generative AI, for example, Microsoft collaborates with OpenAI to develop “Copilot” and is working to integrate generative AI into business tools[5]. Meta also makes “Llama,” an LLM developed by the company, publicly available, creating an ecosystem that can be used by many companies[6]. Through these efforts, big tech companies have comprehensive influence over everything from applications to models and infrastructure (computing resources, data, and specialized human resources), and are driving the evolution and social implementation of generative AI technology.

Although U.S. big tech companies still occupy a major position at each layer, in recent years leading companies around the world, including those in China, have also been focusing on AI business.[7]

In this way, overseas big tech companies have come to exert influence in a wide range of areas, from the foundations of the digital industry to cutting-edge technology. As a result, this movement is bringing about major changes to the traditional industrial structure and having a significant impact on existing telecommunications companies, energy companies, and even startups developing AI.

2. Presence of Foreign Business Operators in the Digital Market and the Current State of Japan’s Competitiveness

While overseas big tech companies, including overseas platform operators, have grown significantly and are exerting a major presence in many digital markets around the world, including Japan, the presence and international competitiveness of Japan’s digital industry in the global market cannot be said to be strong in many areas. This section presents the current competitiveness of Japan’s digital industry as suggested by the share of Japanese companies in the domestic and global digital markets, balance of payments statistics (balance of payments for services) and trade statistics related to the digital field.

(1) Trends in the share of Japanese companies in the global and domestic digital markets

Foreign business operators have a significant presence in digital services, equipment, and devices, which play an important role in today’s digital society.

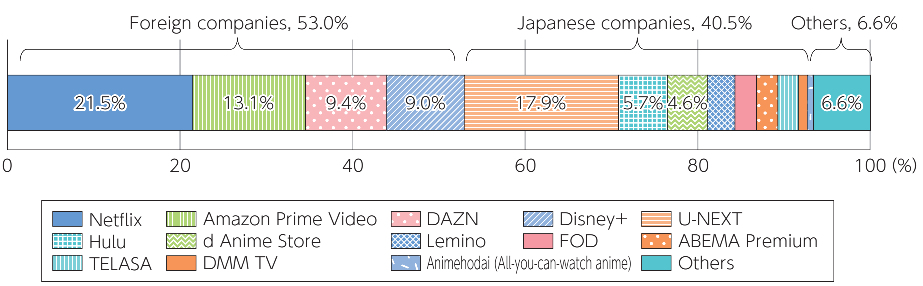
A Domestic market share and trends

Regarding cloud services, in the IaaS and PaaS market in Japan, three companies - Amazon Web Services, Microsoft, and Google - are significantly expanding their market share. Furthermore, Netflix had the highest market share of 21.5% in Japan for subscription video streaming market in 2024, with foreign companies accounting for more than half of the domestic market share **(Figure 1-1-3-5)**.

In terms of video sharing services and SNS in Japan, the usage rate of YouTube exceeded 80% in 2024, and usage rates of foreign business operators’ services such as X, Instagram, and TikTok are increasing year by year[8].

When it comes to digital devices, for example, foreign business operators accounted for a large proportion of the Japanese smartphone market share in 2024, with 59% for Apple, followed by 10% for Google **(Figure 1-1-3-6)**.

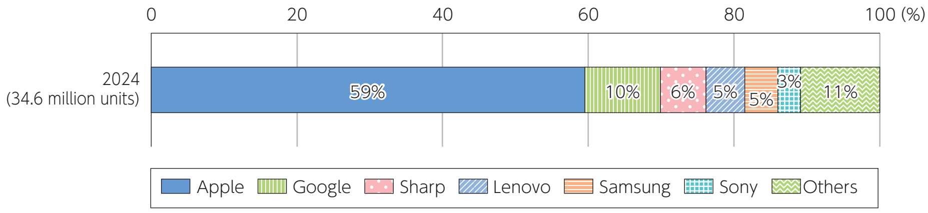
Figure 1-1-3-5 Japanese market share by subscription video streaming service (2024)



(Source) Prepared from GEM Partners Inc. materials[9]

[5] NIKKEI FT the World “U.S. Microsoft and Google’s rising AI costs alarm investors” (February 5, 2024) (https://www.nikkei.com/prime/ft/article/DGXZQOCB0229Z0S4A200C2000000)
[6] METI Commerce and Information Policy Bureau “Towards the realization of a digital society” (October 2024) (https://www.meti.go.jp/shingikai/sankoshin/shin_kijiku/pdf/024_04_00.pdf)
[7] For other AI initiatives by platform operators in the U.S. and China, see “Trends of major platform operators” in Section 6 (2), Chapter 1, Part II
[8] See Section 1, 1 (2) (3), Chapter 1, Part I
[9] GEM Partners Inc. “Subscription video streaming market estimated to reach 526.2 billion yen in 2024, with U-NEXT seeing the largest share growth and closing in on Netflix, which has held the top spot for six consecutive years” < https://www.gem-standard.com/columns/1023>

Figure 1-1-3-6　Japanese smartphone market share (2024)

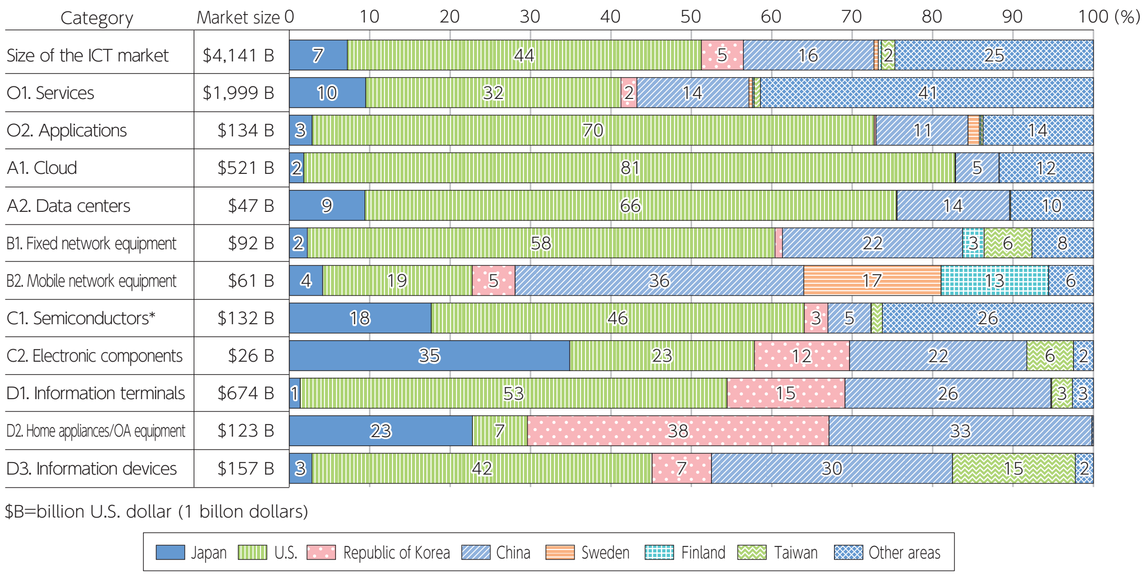


(Source) Omdia

B　Global market share and trends

Looking at the sales-based share of Japanese companies in the global digital market [10]by category, it is estimated that in 2023, with the exception of some categories such as semiconductors, electronic components, home appliances, and office equipment, their share generally remained around 10% or less **(Figure 1-1-3-7)**. Looking at individual devices and services, Japanese companies only had a single-digit share in the large global market for smartphones, PCs, and servers. Although Japanese companies' global share of mobile phone base stations overall is single digits, it accounts for 29% of the open vRAN[11] market alone **(Figure 1-1-3-8)**.

Figure 1-1-3-7　Estimated share of the global ICT market by country and region (by category) (2023)



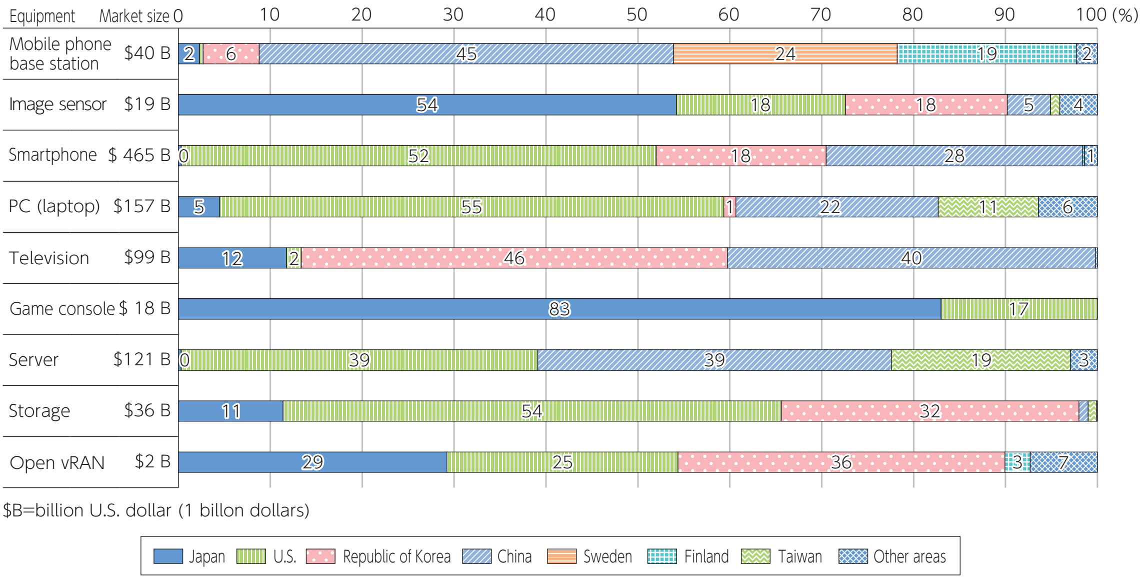
* Excludes semiconductors that can be used for AI applications (AI semiconductors), such as GPUs and MPUs, the latter of which are equipped with built-in AI accelerators.

(Source) Prepared from the MIC "International IoT Competitive Index"

[10] Prepared from the MIC "International IoT Competitive Index" (2023) This share is based on data compiled by company headquarters location for approximately 1,700 companies worldwide. Note that due to limitations of the compiled data, it may not be possible to comprehensively calculate all companies. Due to rounding and the possibility that there may be companies that are not covered by this estimate, "0%" does not necessarily mean that there is no market share for the relevant country or region. It may mean a very small share in some cases.

[11] A standardized system that converts base station functions into software and allows devices and software from different manufacturers to be combined.

Figure 1-1-3-8 Estimated share of the global ICT market by country and region (by device) (2023)



$B=billion U.S. dollar (1 billon dollars)

(Source) Prepared from the MIC "International IoT Competitive Index"

Figure (related date) Estimated share of the global ICT market by country and region (by category) (comparison between 2018 and 2023)
Source: Prepared from the MIC "International IoT Competitive Index"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00057
(Data collection)

Figure (related date) Estimated share of the global ICT market by country and region (by device) (comparison between 2013 and 2023)
Source: Prepared from the MIC "International IoT Competitive Index"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00058
(Data collection)

(2) Trends in the balance of services of digital-related items

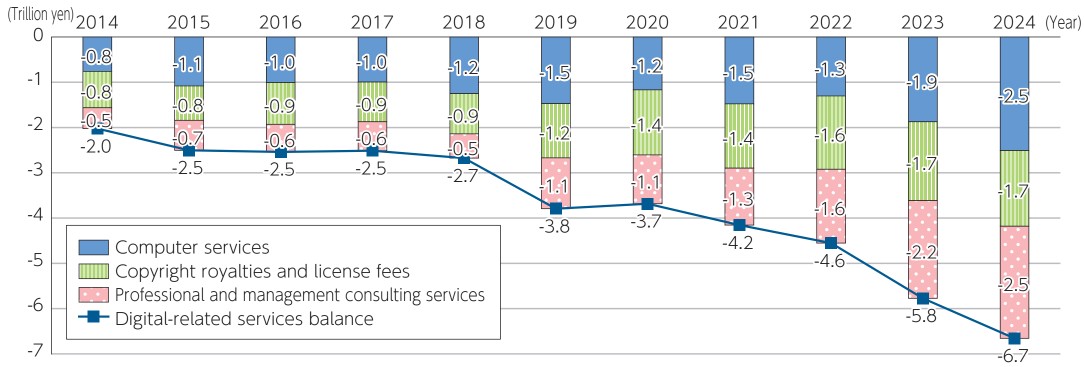
Regarding the services account in the balance of payments statistics, the Bank of Japan Review titled "Globalization of Services Trade as Seen in Balance of Payments Statistics[12]" examines changes in the balance of payments for items classified as digital-related, including (1) computer services; (2) copyright royalties; (3) professional and business consulting services; (4) communications services; and (5) information services (hereinafter referred to as "digital-related items"). Looking at the balance of payments for items (1) to (3), in particular, the deficit has been increasing rapidly in recent years, attracting attention as the so-called "digital deficit.[13]" It should be noted that this includes balance of payments related to services other than the digital field[14].

For example, in 2024, the total balance of payments of (1) computer services, (2) copyright royalties, and (3) professional and business consulting services was in the red by approximately 6.7 trillion yen (an increase of approximately 0.9 trillion yen from the previous year) (if (4) communications services and (5) information services are added to this, the deficit would have been approximately 6.8 trillion yen (an increase of approximately 0.9 trillion yen from the previous year)) [15]. Compared with 2014, the deficit for "copyright royalties" increased by approximately 2.1 times, "computer services" by approximately 3.3 times, and "professional and business consulting services" by approximately 5.4 times in

[12] Bank of Japan "Bank of Japan Review 'Globalization of Services Trade as Seen in Balance of Payments Statistics'" (August 2023) <https://www.boj.or.jp/research/wps_rev/rev_2023/data/rev23j09.pdf>
[13] In some cases, communication services and information services are also included and classified as the so-called "digital deficit."
[14] Computer services include service transactions such as contract software development, computerized information processing, and hardware consulting, maintenance, and repair, as well as license fees when end users acquire general-purpose software such as games online, and the purchase and sale fees for software copyrights. Copyright royalties include license fees for the reproduction and distribution (sale, free distribution, etc.) of copyrighted works (computer software, music, video, characters, literature, academic works, art, etc.). Professional and business consulting services include service transactions related to legal, accounting and management consulting, public relations, advertising and market research. For details of services included in each item, see "Exports and imports in the ICT field" in Section 1 (4), Chapter 1, Part II
[15] For changes in the balance of payments for "digital-related items" when communication services and information services are included, see "Exports and imports in the ICT field" in Section 1 (4), Chapter 1, Part II

2024[16,17] **(Figure 1-1-3-9)**.

Figure 1-1-3-9 Changes in the [18]digital-related services balance



* The total balance of payments of computer services, copyright royalties, and professional and business consulting services

(Source) Prepared from "Balance of Payments Statistics" by the Ministry of Finance

(3) Trends in trade statistics for ICT goods

Based on trade statistics from the Ministry of Finance, the difference between the amount of ICT goods[19,20] exported from Japan and the amount of ICT goods imported [21]into Japan shows that the deficit has been increasing in recent years, reaching a deficit of approximately 3.4 trillion yen in 2024[22]. Looking at the breakdown by item, the largest surplus in 2024 was recorded in "other electronic components," followed by "integrated circuits." On the other hand, the largest deficit was recorded in "mobile phones," and the deficit has been expanding in recent years. The largest deficits were followed by "personal computers," "electronic computer units (excluding personal computers)," and "wired telecommunications equipment." Parts and materials tend to have larger surpluses, while final products tend to have larger deficits.

[16] As background to the increase in the deficit for "digital-related items," for example, the Cabinet Office's "Annual Report on the Japanese Economy and Public Finance FY2024" (August 2024) states that the domestic market size for cloud services, internet advertising, and video streaming has expanded significantly, and points out that an estimate of overseas payments for cloud services shows that the pace of increase has accelerated in recent years, which is thought to explain much of the increase in payments for "computer services." It also points out that much of the increase in the deficit in the "professional and business consulting services" field can be explained by the increase in overseas payments related to Internet advertising in recent years, and that when the deficit for "copyright royalties" is compared with the difference between domestic content-related payments and sales by domestic companies, the increasing trend is similar, although at different levels.

[17] Regarding Japan's overall balance of payments and digital-related balance, the Ministry of Finance's "Issues of Japan's economy and prescriptions for them from the perspective of international balance of payments" panel report (July 2, 2024) states, "Japan's current account balance records a stable surplus, with the surplus in FY2023 being the largest ever," and "Japan's net external assets reaches a record high of 471 trillion yen at the end of 2023, making it the world's largest net asset nation for the 33rd consecutive year." It states, "Looking at each item, only the primary income balance is recording a surplus, while the trade balance is in deficit and the deficit in cutting-edge field such as the digital field is widening in the services balance." It also states, "Forecasts by major think tanks indicate that the current account surplus will shrink or even turn into a deficit as the declining birthrate and aging population continue to progress."

[18] This is sometimes discussed under the terms "digital deficit" or "digital-related balance," but here it is referred to as the "digital-related services balance" in order to distinguish it from trade in ICT goods, which will be explained below.

[19] The following goods are included in the scope of ICT goods in the MIC's "Infor-communications Industry Input-Output Table."
Personal computers, electronic computer units (excluding personal computers), electronic computer accessories, wired telecommunications equipment, mobile phones, wireless telecommunications equipment (excluding mobile phones), communication cables and optical fiber cables, office machines, semiconductor elements, integrated circuits, liquid crystal panels, flat panels and electron tubes, and other electronic components

[20] The scope of ICT goods here is different from the "digital-related goods" compiled by the Japan External Trade Organization (JETRO) in its "JETRO Global Trade and Investment Report." For example, "semiconductor manufacturing equipment," which is included in "digital-related goods" in the "JETRO Global Trade and Investment Report," is not included in the ICT goods here.

[21] The import value in trade statistics is based on CIF (Cost, Insurance and Freight, which includes the price of the cargo as well as insurance and freight to the destination), and the export value is based on FOB (Free on Board, which is the shipping price in the exporting country. It does not include insurance and freight to the destination after shipping). The difference between the export value and the import value here is calculated mechanically.

[22] It is important to note that these statistics only show the amount of exports from Japan to overseas countries and the amount of imports from overseas countries to Japan, and do not reflect exports from Japanese companies' overseas production bases to countries other than Japan, and that when products produced by Japanese companies at their overseas bases are imported into Japan, it is counted as an "import."

Section 4 Changes in the World Situation, Natural Environment, and Society, and the Outlook for the Future Digital Society

In recent years, the world situation has been undergoing major changes, including rising geopolitical tensions and economic instability, and it is said that the outlook is becoming increasingly uncertain and opaque.

For example, according to an index assessed by the United Nations based on factors such as the number of newspaper articles relating to geopolitical risks and uncertainty in global economic policies, geopolitical risks have risen significantly in recent years, triggered by the war in Ukraine and the worsening situation in Gaza. In addition, the index of uncertainty regarding global economic policies has also risen significantly due to the global spread of COVID-19 and the war in Ukraine, and both indices remain at high levels **(Figure 1-1-4-1)**. These geopolitical risks and uncertainty in the global economy are likely to remain high. In fact, the number of armed conflicts occurring around the world is increasing, and there are concerns that tensions may continue to rise **(Figure 1-1-4-2)**.

In addition, the natural environment is continuing to change, with an increase in the occurrence of abnormal weather and the severity of disasters due to global warming, and there are concerns that torrential rain disasters will become more severe, with the number of heavy rain events occurring each year on the rise. Furthermore, with regard to earthquakes in Japan, there is concern that there is an approximately 80% chance of an M8 to M9 earthquake occurring within the next 30 years, particularly along the Nankai Trough (as of March 15, 2025)[1]. In addition, if an earthquake were to occur directly beneath the capital, the risk of earthquake damage becoming more severe as urbanization progresses is increasing.

Moreover, Japan is facing a labor shortage caused by a declining birthrate and aging population, which is becoming more serious every year, with the impact being particularly pronounced in rural areas. Furthermore, compared with the global economic growth, the Japanese economy continues to stagnate. For example, with regard to population changes, the declining birthrate and aging population are progressing in Japan, and the aging rate, which is the proportion of the population aged 65 and above to the total population, is increasing. At the same time, the proportion of people aged 65 and above to the working-age population is also increasing. This impact is expected to be particularly pronounced in rural areas, and the growing concentration of population in urban areas is expected to worsen further in the future. On the economic front, the Japanese economy has been in a long-term slump since the collapse of the bubble economy in the early 1990s, with a low economic growth rate and sluggish labor productivity. According to OECD data, Japan's hourly labor productivity has been at a low level among OECD member countries for a long period of time.

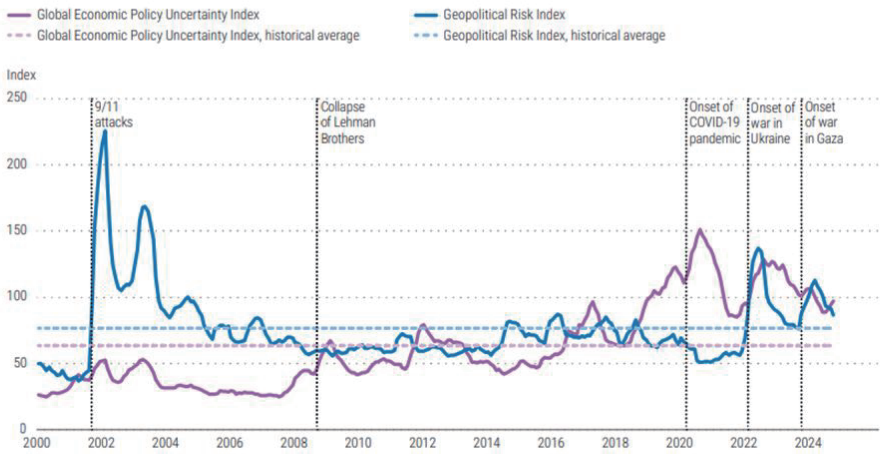
In the future, as digital technologies advance and digital services become more sophisticated and widespread, the digital field, which plays the role as social infrastructure, is expected to expand further. Furthermore, as digital technologies such as AI and robots advance and become more widely used in society, it is expected that they will help solve and alleviate social issues in Japan, which is facing a declining birthrate, aging population, and population decline.

On the other hand, as digital technology becomes increasingly prevalent in socio-economic activities and its presence as a part of social infrastructure grows, there is a growing risk that its negative impacts will become even greater. In addition, as AI becomes more advanced and some predict it may eventually reach a level known as Artificial General Intelligence (AGI)[2,3], there is a concern that the risks associated with digital technologies, including AI, may increase even further.

While promoting further technological development and its utilization to ensure that the benefits of advancing digital technologies can be fully enjoyed in social life and corporate activities, it is also important to continue taking measures to address threats that may expand as digital technology and its use progress.

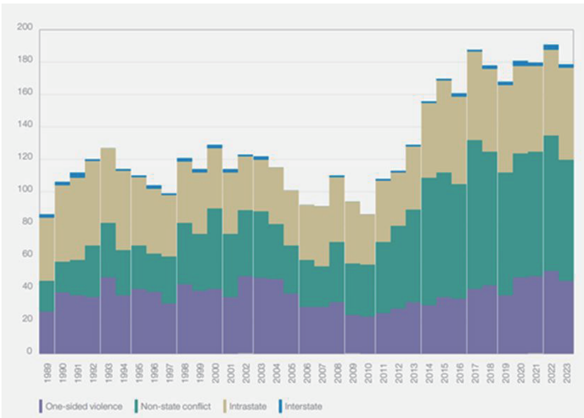
1 Headquarters for Earthquake Research Promotion "Earthquakes occurring along the Nankai Trough" <https://www.jishin.go.jp/regional_seismicity/rs_kaiko/k_nankai/> (Reference March 15, 2025)
2 For example, in July 2024, OpenAI was reported to have released a five-stage roadmap showing progress toward realizing Artificial General Intelligence (AGI). OpenAI CEO Sam Altman reportedly estimates that AI will reach Level 5 within the next decade or so.
3 Bloomberg (2024/7/11) "OpenAI Develops System to Track Progress Toward Human-Level AI"

Figure 1-1-4-1 Changes in global economic policy uncertainty and geopolitical risks



(Source) United Nations "World Economic Situation and Prospects 2025" [4]

Figure 1-1-4-2 Secular changes in the number of armed conflicts in the post-Cold War world



(Source) WORLD ECONOMIC FORUM "Global Risks Report 2025"

Figure (related data) Working-age population and elderly population by prefecture in 2050
Source: Cabinet Secretariat "Council for Creating New Regional Economies and Living Environments (2nd Meeting)" Document 1
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00066
(Data collection)

Figure (related data) Changes in the ranking of labor productivity on a per-hour basis in major countries (OECD member countries)
Source: Prepared from "OECD Data Explorer"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00067
(Data collection)

Figure (related data) OpenAI's roadmap for AGI evolution
Source: Bloomberg (2024/7/11) Prepared from "OpenAI Develops System to Track Progress Toward Human-Level AI"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r07/html/datashu.html#f00068
(Data collection)

[4] United Nations "World Economic Situation and Prospects 2025" < https://www.un.org/development/desa/dpad/publication/world-economic-situation-and-prospects-2025/>