Section 5 From 2015: Establishment of ICT as a Social and Economic Infrastructure

With the appearance and rapid spread of new ICT services including the sharing economy, such as ride sharing, private accommodation and crowdfunding, drones, AI, online lessons and online diagnosis, ICT has become a social economic infrastructure that is indispensable for people's lives. We name the period from 2015 as the "Establishment of ICT as Social and Economic Infrastructure" and provide an overview of the situation of the ICT sector in and outside of Japan during this period.

1. International Situation and Trends Outside of Japan

In various fields including ICT, China further grew as an economic power and achieved the second largest GDP in the world. China also took the number 1 spot, followed by the United States and Japan, in terms of the output of information and communication industries in 2014. Originally the United States had been number 1 in 2000.[47] In this context, criticism of China mounted in the United States for its violation of intellectual property rights and its demands for forced technology transfers. Amid a technology leadership competition between the United States and China, the United States enacted the 2019 National Defense Authorization Act, followed by The Foreign Investment Risk Review Modernization Act (FIRRMA) in August 2018, and the screening of foreign investments in the United States by the Committee on Foreign Investment in the United States (CFIUS) was strengthened. At the same time, the Export Control Reform Act (ECRA) was enacted to strengthen export controls.[48] The **relationship between economic activities and security** with a focus on high-tech industries achieved recognition as a real policy theme[49] **(Figure 1-5-1-1)**.

Figure 1-5-1-1 Trends in the initiatives for economic security in the United States and China

Country	Trends of initiatives for economic security
The U.S.	"The National Strategy for Critical and Emerging Technologies" was released in October 2020. Pillars of the strategy include promoting National Security Innovation and Industrial Base (NSIB) and to protect the country's tech advantages in critical and emerging technologies in order to lead the world in these technologies. The strategy identifies 20 technology area priorities, which include: "Communication and Networking Technologies," "Quantum Information Science," "Semiconductors and Microelectronics" and "Space Technologies." The 2021 Innovation and Competition Act that passed the Senate in June 2021 includes the Endless Frontier Act, the Strategic Competition Act, the Securing America's Future Act (provisions related to the Committee on Homeland Security and Governmental Affairs of the Congress) and the Meeting the China Challenge Act.
China	U.S. sanctions against China (high-tech cold war) made China face the vulnerability of its own supply chains. Starting with Huawei in May 2019, one Chinese high tech company after another were placed on the trade restriction "Entity List", which was designated by the U.S. Department of Commerce under the Export Administration Act, and became unable to procure American products. In order to overcome this weakness, the country announced a policy to upgrade industrial infrastructure, modernize industry chains and promote digitalization in "the 14th Five-year Plan."
Reference Japan	The government held expert meetings for economic security legislation to discuss economic security legislation from technical viewpoints. A bill for ensuring security by integrally taking economic measures with the four pillars of "supply chain," "critical infrastructure," "public-private technical cooperation" and "patent non-disclosure" was submitted to the 2022 ordinary session of the Diet and enacted in May of the same year.

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

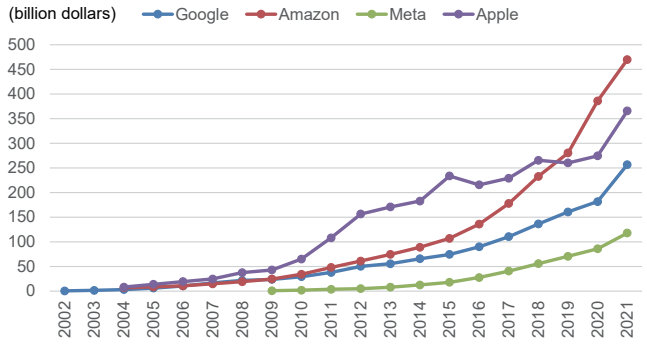
[47] ONOZAKI, Ayako (2021) "The impact of ICT progress at the inter-industry structure: A comparative study of Japan, the U.S., and China using IO tables," InfoCom Research Inc., InfoCom Economic Study Discussion Paper Series, No.16.
https://www.icr.co.jp/service/infocom-ict/download/discussion-paper/pdf/2021/DP_16_202101.pdf
She calculates and analyzes the output, added values, etc. of the information and communication industries (ICT hardware, communications, information services and contents) of the world and by major countries in 2000 and 2014, which was the latest year with available data by using the World Input Output Database (WIOD 2016).

[48] MIC, "Summary of the White Paper on International Economy and Trade"
https://www.meti.go.jp/report/tsuhaku2019/2019honbun/i0110000.html

[49] SHINOZAKI, Akihiko, "Cases to consider for Japan's economic activities and security in the face of Ukraine Crisis" Business + IT (March 15, 2022) https://www.sbbit.jp/article/cont1/82774?page=2

Since the mid-2010s, **big data analysis using AI, etc., has grown** and the services provided by global platformers have been further upgraded. Specifically, global platformers collect and analyze personal data including end users' attributes, locations, e-commerce purchase history, and video/music viewing history, and provide value-added services to present advertisements and other information according to the preferences of individual end users. On the other hand, as the market power of the global platformers in online businesses has further grown **(Figure 1-5-1-2)**, issues have been pointed out with respect to **data oligopoly and handling** by the global platformers and rule setting on platforms. Specifically, concerns are increasing about the situation where actions and preferences are managed by specific enterprises as a result of the concentration of data with enormous economic value to a few global platformers. In addition, as enormous amounts of data are transferred across borders, privacy and security risks have become apparent when transferred data are not appropriately managed. Concerns are rising about data management by the global platformers who are the recipients of especially great amounts of data.

Figure 1-5-1-2 Changes in the sales of GAFA



(Source) Prepared based on Statista data

Amid the rapid spread of smartphones and the evolution of mobile communication systems into local/social infrastructure, countries all over the world are investing in 5G networks and allocating frequencies to 5G. Starting with the **launch of 5G services** for smartphones in the United States and ROK in April 2019, 5G services have since started in countries around the world.

Against the background of the COVID-19 pandemic, which started in 2020, the role of ICT further expanded as it enables non-contact/non-face-to-face activities in social/economic activities. On the other hand, as exemplified by the Russian invasion of Ukraine in February 2022, ICT is also being abused as a means of assault, such as cyberattacks and the spreading of false information.[50]

[50] YONETANI, Nami (2022) "Russian Invasion of Ukraine and Trends in the ICT Sector," FMMC Researcher Report, March 2022, No.1. https://www.fmmc.or.jp/Portals/0/resources/ann/report_ru_220315_zenpen.pdf

2. Trends in the ICT sector of Japan

With the increasingly complicated international situation and rising influence of the global platformers, Japan is taking various actions to deal with these issues, including upgrading and increasing the resilience of ICT infrastructure and promoting data governance (See Chapter 2 for the details).

Considering that the number of telephone subscriptions has decreased and that transit switches and signal switches will reach their maintenance limit around 2025, NTT announced a plan in 2015 to **change the Public Switched Telephone Network (PSTN) of NTT East and West to an IP network** by 2025 and began this change in 2021.

While Communication infrastructure continues to be further upgraded, NTT DOCOMO, KDDI and SoftBank launched 5G services in March 2020. 5G has special features, such as high speed/large capacity, high reliability/low delay and multiple simultaneous connections. Its use cases include 4K/8K live streaming, highly immersive VR/AR experiences, multifaceted sports viewing, remote surgery and automatic driving. In addition, a **Local 5G** system has been established in Japan. Local 5G is available for various entities beyond carriers, and can be adapted according to local or regional needs. Demonstration experiments that are conducted to promote the utilization of 5G in diverse fields include medical/health care, agriculture, fisheries and manufacturing (in factories).

Discussions toward **6G/Beyond 5G, which will be the communication standard to follow** 5G, have started in many countries. In Japan, too, discussions have started on technical strategies for the construction of next-generation networks toward the 2030s.

Upgrading of broadcasting networks are also continuing to progress: new full-fledged **4K8K satellite broadcasting** for homes started in BS in 2018 and the number of televisions with which new 4K8K broadcasting can be viewed reached 12.64 million in April 2022.[51]

As the upgrading of ICT progresses in this way, various services that take advantage of ICT have appeared and ICT use has spread in various fields of social/economic activities.

For example, there continues to be progress in the **sharing economy,** that is to say economy vitalization activities to make assets (including intangible assets such as skills and time) held by individuals available for other individuals via matching platforms on the Internet.[52] Various share services have appeared and grown since the mid-2010s, such as the sharing or sale of "goods" (e.g. Mercari), "space/place" (e.g., Airbnb), and "means of transportation" (e.g., Uber), and the sharing of "money" whereby participants lend money to other people and organizations (e.g., READY FOR), and the sharing of "skills/human resources" including housekeeping and childcare (e.g., AsMama).

Video streaming over the Internet has rapidly grown since 2015, the year that Netflix and Amazon Prime Video started **video streaming services** in Japan. Information providers have further diversified because anyone can easily distribute or provide content with YouTube, TikTok, etc.

In addition to investments in and content provision to video streaming services, some broadcasters have constructed their own platforms to provide VOD (Video On Demand)[53] services and streaming services based on program organization.[54] For example, TVer was launched in 2015 through a common portal to make free internet video streaming available (missed-program webcasts) and it has been implemented individually by five private key stations in Tokyo.[55] Its reproduction number is steadily increasing.[56] In addition, **real-time program streaming services started being provided** by Nippon Television from October 2021, and by Television Asahi, TBS, Television Tokyo and Fuji Television Network from April 2022.

Use of AI has progressed with its incorporation in various goods and services. Examples close to daily life include internet search engines, audio response application of smartphones, voice search/input functions and cleaning robots. Humanoid robots equipped with AI are also being put into practical use as exemplified by Pepper of SoftBank Robotics.

As described in the Introduction, the utilization of ICT has grown in various fields of the public's socioeconomic lives, including disaster management and medical care, and the COVID-19 pandemic has further pushed **ICT utilization in terms of enabling a non-contact/non-face-to-face lifestyle** that incorporates telework, online learning and online medical care.

As a more specific example, the COVID-19 pandemic has led to the rapid introduction of telework by private enterprises. According to the Communications Usage Trend Survey of MIC, telework implementation rate among enterprises greatly increased from 20.2% in 2019 to 51.9% by the end of August 2021.[57]

In the education sector, **online lessons** were implemented due to the temporary closure of elementary, junior-high and high schools and universities. According

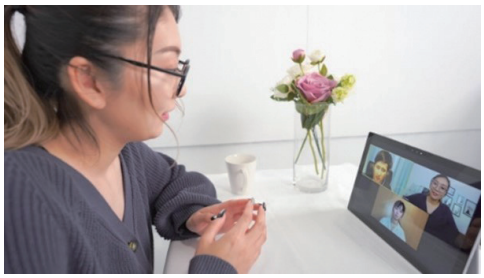
[51] The Association for Promotion of Advanced Broadcasting Services: https://www.apab.or.jp/
[52] Government CIO Portal Sharing Economy Promotion Office website: https://cio.go.jp/share-eco-center
[53] Video services to allow users to view already broadcasted programs and movies when they want to view the program after the end of release
[54] Unlike VOD, the service distributes video contents according to a predetermined program (timetable)
[55] VOD services through which already broadcasted programs can be viewed for a fixed period (e.g., a week) just after their broadcasting
[56] https://www.soumu.go.jp/main_content/000808154.pdf
[57] MIC "Communications Usage Trend Survey" (survey at the end August 2021) covering enterprises with more than 100 full-time employees https://www.soumu.go.jp/johotsusintokei/statistics/statistics05.html

to a survey conducted by the Cabinet Office from April to May 2020, just after the declaration of a state of emergency, the ratio of elementary/junior-high school students receiving online education was 45.1% nationally and 69.2% in the 23 Wards of Tokyo.

In the medical field, considering the difficulties people faced in visiting medical institutions due to the spread of COVID-19, telephone and **online diagnosis and prescription** were made possible from initial examination as provisional/exceptional measures in April 2020. As a result, online medical care was available in 15.0% of all medical institutions as of the end of June 2021. Medication education over the phone or via information/communication equipment was also allowed, provided that pharmacists implemented it appropriately after obtaining information on the patient and their prescription situation.[58]

In response to the increase in working from home and staying indoors, online events rapidly spread, such as online meetings and drinking parties using social media, teleconference systems (e.g., Zoom) and online concerts using video streaming platforms, etc. **(Figure 1-5-2-2).**

Figure 1-5-2-2 Online meeting



(Source) AC

As described above, ICT has come to fulfill a role as the "infrastructure of infrastructure" that supports all social and economic activities, including education, medical care and labor.

[58] See Ministry of Health, Labour and Welfare, "Annual Report on Health, Labour and Welfare" Part 1, Chapter 1 Section 1 https://www.mhlw.go.jp/stf/wp/hakusyo/kousei/20/index.html