Chapter 2

Future Prospects for Japanese Society

Considering that, as described in Chapter 1, ICT has become an infrastructure that supports every social/economic activity, Chapter 2 takes a look at the changes expected in Japanese society in the future, analyzes the anticipated role of ICT and summarizes the challenges that are coming to the surface with the advancement and diversification of ICT and its spread in society.

Section 1 Prospects for the Role of ICT in Future Japanese Society

In Section 1, we provide an overview of the social changes expected in Japan in the future and analyze how ICT will respond to individual changes and also how it will change society.

1. Prospects for Japanese society in the future

The prospects for Japanese society in the future include increasingly serious social/economic challenges, such as shrinkage of the working-age population, decline of local economies, intensifying disasters, aging of infrastructure, further expansion in data distribution and increase in traffic, and acceleration of global warming due to growing power consumption.

(1) Shrinkage of the working-age population

With a declining birthrate, the working-age population (aged 15 to 64) of Japan has been declining from its peak in 1995 and is expected to fall to 52.75 million by 2050 (29.2% decrease from 2021).[1] There are concerns that the shrinkage of the working-age population will aggravate various social/economic issues, including labor shortages and the shrinkage of the economic scale due to a decrease in domestic demands.

(2) Declining birthrate and aging of population in rural areas

The falling population in combination with population aging is more significant in rural areas. While the ratio of the population aged 65 and over is expected to become over 30% in metropolitan areas by 2045, it is predicted to exceed 40% in rural areas. In particular regard to rural areas, there are concerns over increasingly serious challenges, including a shortfall in human resources in local economy/industries and difficulties in maintaining communities.

(3) Frequent and intensified disasters

In recent years the frequency of heavy rain with a risk of storm disaster has sharply increased, while accompanying landslide disasters are also on the increase.[2] Furthermore, according to a prediction by the Headquarters of Earthquake Research Promotion,[3] the probability of a Nankai Trough earthquake (magnitude 8 to 9) within 30 years is 70 to 80%, and the probability of an earthquake of around magnitude 7 (accompanying the sinking of the plate along the Sagami Trough) is around 70% during the same period (as of January 1, 2022).[4] There are concerns that natural disasters will continue to increase in frequency and intensity.

(4) Aging of infrastructure

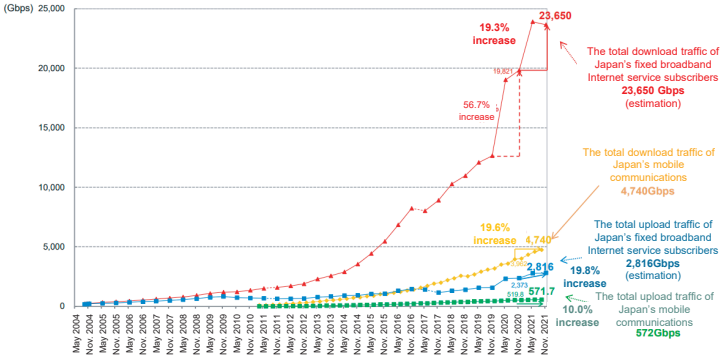
Social infrastructure that was developed during an era of high growth in Japan is rapidly aging. According to an estimation on the aging of social infrastructure from 2018 to 2033 by the Ministry of Land, Infrastructure, Transport and Tourism, the ratio of facilities that date back to more than 50 years ago will increase at an accelerated pace: from about 25% to about 63% for highway bridges, and from about 32% to about 62% for river management facilities.[5] There are concerns about increasing maintenance and renovation costs, as well as the occurrence of major accidents due to the aging of social infrastructure.

(5) Further growth in data distribution and traffic increase

Internet traffic in Japan doubled in two years from November 2019, just before the spread of COVID-19, and November 2021 **(Figure 2-1-1-4)**. There is a prediction that global IP traffic will increase more than 30 times by 2030 and 4,000 times by 2050.[6] It is expected that traffic will continue to also increase in Japan with the digitalization of socioeconomics.

[1] https://www8.cao.go.jp/kourei/whitepaper/w-2022/zenbun/pdf/1s1s_01.pdf
[2] https://www.bousai.go.jp/taisaku/gekijinhukko/list.html
[3] An organization that was established to communicate results of survey research on earthquakes and promote unified countermeasures by the government by using the lessons learned from the Great Hanshin Awaji Earthquake on January 17, 1995
[4] https://www.jishin.go.jp/evaluation/long_term_evaluation/lte_summary/
[5] https://www.mlit.go.jp/hakusyo/mlit/r02/hakusho/r03/html/n1221000.html
[6] https://www.jst.go.jp/lcs/proposals/fy2018-pp-15.html

Figure 2-1-1-4 Changes in Internet traffic



(Source) MIC (2022), "Aggregation result of Internet traffic in Japan (in November 2021)"[7]

(6) Fast rising electric power consumption and acceleration of global warming

With the progress in ICT utilization and increase in traffic, power consumption by ICT-related equipment is also on the increase. For example, it has been estimated that the world's data centers consume 1 to 2% of global power consumption. There is an estimation that, assuming that power consumption will increase in proportion to the increase in IP traffic in Japan, ICT-related equipment alone will consume nearly double the amount of current annual power consumption **(Figure 2-1-1-5)**. There are concerns over an acceleration in global warming due to rapidly growing increases in power consumption.

Figure 2-1-1-5 Predictions for IT-related power consumption

Forecast of IT-related power consumption	2016	2030	2050
IP traffic (ZB/year)	4.7	170	20,200
Power consumption (Japan: TWh/year)	41	1,480	176,200
Power consumption (World: TWh/year)	1,170	42,300	5,030,000

(Source) Center for Low Carbon Society Strategy, Japan Science and Technology Agency (2019) "Impact of Progress of Information Society on Energy Consumption (Vol. 1): Current Status and Future Forecast of Data Center Energy Consumption and Technical Issues[8]

2. Prospect for the roles to be fulfilled by ICT

In order to cope with various social and economic challenges, including the shrinkage of the working-age population, decline of local economies, and intensifying disasters which are expected to worsen in the future, it is necessary to reform society as a whole through activities toward improving labor productivity, expanding labor participation and regional vitalization. Next, we examine what role ICT can play in this process to contribute to social reform.

(1) Improving labor productivity and expanding labor participation through ICT

While labor shortages due to the shrinkage of the working-age population have been forecasted, improvements in labor productivity and expansion of new labor participation are expected from the utilization of ICT.

Examples include: the use of robots/AI to replace manual work to reduce the labor needed to generate the same products/added values, or to improve work efficiency through the speeding up of work and accuracy improvement, and analysis of big data to further improve efficiency of production and distribution processes.

Furthermore, it is expected that the use of telework, satellite offices and cloud sourcing will enable people to work regardless of geographic limitation and empower those who have difficulty in working for various reasons, such as childcare, family care or disabilities to choose from diverse and flexible working styles, which would contribute to an improvement in the labor force participation rate.

(2) Regional revitalization through ICT

While local economies are expected to shrink, use of ICT could expand the trading area of local enterprises, and enable working styles and use of services not limited by geographic conditions, which would contribute to regional revitalization.

For example, spread of ICT expanded markets without limits on time and location nationwide and around the world. Thanks to lower matching costs, different kinds of manufacturing at even a small scale can find

[7] https://www.soumu.go.jp/joho_tsusin/eidsystem/market01_05_03.html
[8] https://www.jst.go.jp/lcs/proposals/fy2018-pp-15.html

markets without scale restrictions, and small local enterprises can provide goods and services that meet various needs in every region.

The development of ICT enables telework and other working styles not limited by location, and people living in rural and urban areas can enjoy the same services (e.g., online shopping, telemedicine, remote education). These new working styles and lifestyles are expected to enable young people living in their hometowns to work for companies in metropolitan areas, and people in metropolitan areas to move to rural areas while maintaining their current jobs and to use various services there, which would contribute to increasing the resident populations of rural areas.

(3) Prompt and efficient information collection and communication using ICT

As disasters are increasingly fierce and frequent, use of ICT is expected to contribute to efficient and effective disaster prevention and mitigation through prompt, efficient and detailed collection of disaster-related data as well as the prompt and accurate provision of information for evacuation etc.

For example, the integrated handling of information from a variety of sensors and high-definition videos that make use of the ultra-high speed and large capacity of 5G would improve prediction accuracy for river flooding and enable the prompt issuing of evacuation orders. When there is a disaster, high definition videos from cameras installed on-site or mounted on drones can be transmitted via ultra-high-speed and low-delay 5G for accurate understanding of the disaster or the accident situation to improve evacuation efficiency. Regarding the provision of information for residents, AI analysis of positional information that is based on the built-in GPS of smartphones, and information on applications and information sent by victims, etc., is expected to enable the efficient distribution of information needed by victims, which would contribute to prompt and accurate evacuations.

(4) Maintenance and management of social infrastructure by using ICT

Amid concerns about the rapid aging of social infrastructure, use of ICT is expected to enable more efficient and sophisticated infrastructure maintenance, renovation and management, and contribute to the long life of social capital and reduction/leveling of total cost of social capital, including maintenance and renovation in the long run.

For example, the transmission of 4K/8K and other high-definition videos will improve the precision of monitoring, while analyzing videos with increased information volume using AI technologies will enable more prompt and detailed detection of abnormalities in electric cables, roads, building outer walls, railway lines, etc. Furthermore, ultra-high-speed and low-delay transmission through 5G from cameras installed on sites, mounted on drones and inspection vehicles will enable real-time monitoring and management.

(5) Contribution to Green Society

At a time when global warming is expected to get worse, the power consumption of ICT equipment is also expected to increase. Power saving through the development and introduction of new technologies is expected to contribute to the realization of a green society (Greening ICT). It is also expected that the use of ICT in society, including homes and enterprises, will promote the realization of a Green Society through operational efficiencies and reductions in the movement of people and merchandise (Greening by ICT).

Efforts for the Greening ICT include: the development of software with small environmental load in upper layers, development of all-photonics networks for low power consumption in the network layer, and reduction in power consumption through the virtualization of mobile phone base stations. It is expected that the greening of ICT itself through the development and introduction of these new technologies will contribute to the realization of a green society.

For the Greening by ICT, the manufacturing industry is advancing smart factory initiatives where ICT is used for saving labor and optimizing production lines to improve energy efficiency per unit of production. In homes, use of HEMS (Home Energy Management System), which uses ICT to optimize power use by understanding the power consumption and operating conditions of electric equipment for a fixed period, will contribute to energy saving and environmental load reduction. In addition, expanding the use of digital services, including video and music streaming and e-books, is expected to lead to a reduction in CO2 emissions through reduced human movement and physical distribution.