Chapter 6

Toward Living Further in Harmony with Digital Technologies

Various digital services utilizing AI are increasingly permeating our lives, and technologies such as the metaverse, robotics, and autonomous driving are expected to contribute to solving various social and economic issues faced by our country, such as regional revitalization and disaster prevention. Effectively utilizing these technologies and promoting initiatives towards realizing a society where we coexist with them is crucial. Additionally, it is said that in the near future, AI will develop self-learning capabilities and be able to respond to various situations, leading to the emergence of Artificial General Intelligence (AGI). Furthermore, there are predictions that by 2045 (or even earlier), AI will reach a technological singularity, surpassing human capabilities. This chapter provides an overview of the challenges and necessary initiatives for further coexistence with digital technology in the future.

Section 1 Issues and necessary initiatives to live further in harmony with digital technologies

1. Promotion of use of digital technologies to strengthen industrial competitiveness and solve social issues

Digital technology is an indispensable element for strengthening industrial competitiveness and solving

(1) Initiatives to strengthen AI development capabilities

The advancement of AI technology brings progress in other technologies such as robotics and autonomous driving, serving as a key to providing more advanced services. By utilizing AI, it is expected to improve productivity, strengthen industrial competitiveness, and create new markets, making AI a driving force for economic growth. In the field of research and development, there are emerging research areas that aim to innovate research processes through autonomous driving using AI, thereby transforming the foundation of research and development across various fields¹. Additionally, from a security perspective, AI is being utilized in the fields of cybersecurity and military applications. Given the broad and significant impact of AI on improving our lives and welfare, industrial competitiveness, technology (research and development), and national security, it is increasingly important to enhance and expand our own AI development capabilities.

social issues.

Therefore, the government recognizes the importance of enhancing and expanding the computational resources and data, which are considered the infrastructure for AI development², and has begun supporting business initiatives and research and development. Regarding computational resources, support is being provided for the development of LLMs using the supercomputer "Fugaku"3 and the provision of GPU cloud services. Additionally, efforts are being made to collect, generate, and manage high-quality training data, which significantly affects the performance of AI models, and to share such high-quality data among research institutions and companies. The NICT is leveraging its knowledge accumulated through research and development in AI natural language processing, such as multilingual speech translation, to enhance and expand large volumes of high-quality and safe Japanese language data suitable for AI learning, and is providing access to this

¹ One of the six cross-disciplinary goals of the "Strategic Creative Research Promotion Project for FY2024," announced by the MEXT on March 15, 2024, was "Research Innovation through Autonomous Driving." The autonomous research approach aims not only to improve efficiency and speed up the most time-consuming experimental processes through the automation of physical experiments by robots, but also to achieve logical reasoning beyond human cognitive abilities by finding regularities in complex phenomena that cannot be fully described by equations during hypothesis formulation and prediction processes. This approach is expected to bring about a paradigm shift in research activities. The autonomous research approach has the potential to innovate scientific research methodologies by overcoming human cognitive limitations and biases, enabling the elucidation of complex phenomena and the exploration of new research areas. https://www.mext.go.jp/b_menu/houdou/2023/mext_000010.html

² "Tentative Summary of AI Issues" (2nd AI Strategic Council, May 26, 2023). Refer to 3-3 AI development capabilities in page15. https://www8.cao.go.jp/cstp/ai/ai_senryaku/2kai/ronten.pdf

³ Tokyo Institute of Technology, Tohoku University, Fujitsu, and RIKEN announced they develop a large-scale language module using the supercomputer "Fugaku" in the "Fugaku" policy framework. From August 2023, Nagoya University, CyberAgent, Kotoba Technologies Inc. have been added to the list of participating institutions.

[&]quot;Regarding development of large-scale language model distributed parallel learning method for supercomputer "Fugaku" policy response framework" May 22, 2023, https://www.titech.ac.jp/news/2023/066788

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data to private companies and academia⁴. Furthermore, support is being provided to strengthen research and development capabilities for efficient and accurate learning methods, and methods to ensure transparency and reliability through the elucidation of the principles of foundational models⁵.

Through such collaboration between industry, government, and academia, it is important to promote the development of domestic LLMs, create models tailored to domestic needs, and provide AI optimized for the Japanese language and culture (See Section 1 in Chapter 4.).

Moreover, the advancing development of domestic LLMs is expected to have significant potential for expanding the construction of unique language models in non-English-speaking countries such as Southeast Asian nations⁶. In Southeast Asian countries, it is predicted

(2) Initiatives for utilizing digital technologies to solve social issues

Japan faces various social challenges such as demographic changes, economic structural shifts, aging infrastructure, and increased natural disaster risks. In particular, local communities are grappling with issues such as labor shortages, declining regional industries, and the maintenance of public and quasi-public services. The use of digital technology is expected to play a crucial role in addressing these challenges.

The MIC has been working on promoting regional community digital transformation (DX) by establishing information and communication infrastructure to support the revitalization of regional economies, based on "The Vision for a Digital Garden City Nation" and "Digital Administrative and Financial Reform". However, there is a recognition that not all previous efforts in regional community DX have directly contributed to solving regional issues. As a result, a "Discussion Panel on the Information and Communication Infrastructure and Utilization for Achieving Vibrant Regional Communities" has been convened since December 2023 to consider the policy direction necessary to achieve vibrant and diverse regional communities. As one of the discus-

that developing their own language models in a short period is challenging due to factors such as data scarcity. Therefore, expanding the know-how of constructing Japanese language models to the languages of Southeast Asian countries is seen as a good opportunity for the Asian region to gain economic competitiveness against Europe and the U.S. Additionally, in the context of the deployment of services by Big Tech companies from Europe and the U.S. in Japan, it is conceivable to earn licensing fees by utilizing domestically developed Japanese language models. Traditionally, the difference in language spheres between Europe and the U.S. has been a handicap in economic competition, but this situation can be turned to our advantage. By strategically investing in the above, it is expected that the international presence of domestic LLMs will be established.

sion items of this panel, there was a discussion on "the ideal way to establish an information and communication usage environment required for each use case" from the perspective of how to develop and popularize the optimal information and communication usage environment for use cases such as autonomous driving for maintaining local community transportation and smart agriculture for sustaining local industries. In the "Report (Draft)" of May 2024, it was indicated that "we should promote the verification and establishment of utilization models for advanced technologies, including AI and the metaverse, which are essential elements for advancing DX in areas such as automatic management of agricultural products, disaster countermeasures, and mobility for regional industrial promotion and solving social issues, and we should advance the verification and categorization of the optimal combination of communication technologies according to the usage purposes. The panel is scheduled to finalize its recommendations in July, and the MIC aims to promote policies necessary for realizing vibrant and diverse regional communities based on the panel's findings.

(3) Efforts for improving market environment and user protection through enhanced transparency

Traditionally, the IT industry has been led by Big Tech companies represented by "GAFAM" (Google, Amazon, Facebook (now Meta Platforms), Apple, and Microsoft). However, with the advancement and proliferation of AI, there are growing concerns about the further concentration of data within these Big Tech companies. In the digital market platforms and cloud services, Big Tech companies already hold dominant positions. With the advent of AI, tech companies referred to as the "Magnificent Seven" and the "Big Four" are expanding their dominance. The "Magnificent Seven" includes GA-FAM, NVIDIA, which is said to hold nearly 90% of the market share for GPUs essential for generative AI⁷, and Tesla, one of the world's largest electric vehicle manufacturers. The "Big Four," also known as "GOMA" (Google, OpenAI, Microsoft, and Anthropic (a the U.S. startup)), have already accumulated technical and business advantages in the digital market⁸.

⁴ "Providing access to learning language data maintained by the MIC and the NICT" (September 8, 2023, 5th AI Strategic Council Materials 3-4) https://www8.cao.go.jp/cstp/ai/ai_senryaku/5kai/datateikyou.pdf

⁵ "Major AI-related measures (draft)" (August 4, 2023, 4th AI Strategic Council Materials 2) https://www8.cao.go.jp/cstp/ai/ai_senryaku/4kai/shisaku.pdf

⁶ Based on an interview with Professor KAWAHARA Yoshihiro, Graduate School of Engineering at the University of Tokyo (conducted on March 19, 2024)

⁷ "Why did semiconductor giant NVIDIA become a "super profitable" company with a high profit? Approaching the secret behind the "3.7 times growth in sales" of a \$2 trillion company," "Business Insider Japan PREMIUM" March 11, 2024 issue

⁸ The Atlantic, "The Future of AI Is GOMA Four companies are taking over everything." ">https://www.theatlantic.com/technology/ar-chive/2023/10/big-ai-silicon-valley-dominance/675752/> (accessed on February 29, 2024)

The reasons for the increasing competitive advantage of these Big Tech companies include network effects⁹ and high switching costs¹⁰, as well as the enormous costs associated with AI development and operation. For example, it is said that the operation of OpenAI's generative AI "ChatGPT" costs 700,000 dollars (about 100 million yen) per day¹¹, and the execution of Google's generative AI "Bard" is estimated to cost about ten times that of Google Search¹².

Additionally, Microsoft, Google, and Amazon account for about two-thirds of the global cloud computing market share, and Meta Platforms owns a powerful proprietary data center network. Companies developing AI products need to rely on one or a combination of cloud services from Microsoft Azure, Google Cloud Platform, or Amazon Web Services (AWS). The more these major cloud platforms are used, the more profitable it becomes for Big Tech companies, thereby increasing their dominance.

Furthermore, creating AI programs requires not only computing power but also vast amounts of training data. These Big Tech companies have a competitive advantage in collecting massive amounts of data, putting them in a highly favorable position¹³.

In response to the increasing dominance of Big Tech

companies in the digital market, Japan has taken steps to enhance the transparency and fairness of transactions on digital platforms. In February 2021, the "Act on Improving Transparency and Fairness of Digital Platforms" (Act No. 38 of 2020) was enacted. This law designates certain digital platform providers, particularly those offering platforms where the need to enhance transaction transparency and fairness is high, as "specified digital platform providers."¹⁴ These providers are required to disclose transaction terms to users, provide advance notice of changes, ensure fairness in operations, handle complaints, and report on their operational status, including information disclosure.

Furthermore, in 2024, recognizing that providers of specific software essential for smartphone use, such as mobile OS, app stores, browsers, and searching services, are in an oligopolistic state by a few powerful companies, and that various competitive issues are arising, a bill titled "Act on Promoting Competition in Specific Software Used in Smartphones" was submitted to the Diet and passed in June. This law aims to ensure security and privacy while fostering innovation through competition, allowing consumers to choose from a diverse range of services and enjoy the benefits thereof.

2. Ensuring the healthiness of information circulation in digital space, improving the literacy and developing human resource

(1) Efforts to ensure the healthiness of information circulation in the digital space

The way citizens access information is undergoing significant changes, as exemplified by the evolving relationship between traditional media and their readers/ viewers, and it is expected to continue evolving. Particularly among the younger generation, there is a noticeable trend of frequently using news curation services like Yahoo! News and SmartNews to obtain news, which has led to concerns that the presence of individual news organizations providing content to these services is diminishing¹⁵. Additionally, search results from search engines and content on social media platforms are displayed based on algorithms that reflect users' browsing histories, raising issues such as "Filter Bubbles"¹⁶ and "Echo Chambers."¹⁷



Figure (related data) Behavior when to obtain latest news online in the 2023 White Paper on Information and Communications in Japan (Japan, the U.S., Germany, China) URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r06/html/datashu.html#f00087 (Data collection)

⁹ This concept means that the more participants there are in a network, the greater the value of that network and the more participants it attracts. As a result, services with a large number of users tend to be able to acquire more users and expand in scale. (Chapter 2, Section 2 in 2023 White Paper on Information and Communications)

¹⁰ This concept means that financial, procedural, and psychological burdens that occur when switching from the product or service currently being used to another alternative product or service. If a platform provider provides various services in conjunction with each other, the effect of reducing switching costs will be higher, and the co-creation effect between these services will be weakened. (Chapter 2, Section 2 in 2023 White Paper on Information and Communications)

¹¹ "The hegemony of the IT industry will change from "GAFAM" to "GOMA"...The impact of "generative AI" that will completely change the power relationship of Big Tech", "President Online" February 16, 2024 issue

¹² The same as above.

¹³ AI Now Institute, "2023 Landscape CONFRONTING TECH POWER"https://ainowinstitute.org/2023-landscape>(accessed on February 28, 2024)

¹⁴ As of October 2022, there are three companies in the "Comprehensive online shopping mall": Amazon, Rakuten, and Yahoo, and two companies in the "App store": Apple, iTunes, and Google LLC, and there companies in the "online advertising": Google, Meta Platforms, and Yahoo. They are subject to regulation.

¹⁵ Based on an interview with Professor HEIWA Hiroshi, College of Liberal Arts, J.F. Oberlin University (conducted on March 8, 2024).

¹⁶ "Filter Bubble" is an algorithm that analyzes and learns from the search history and click history of individual internet users, so that information that each user wants to see is displayed on a priority basis, whether they want it or not. It refers to an information environment in which users are isolated from information that does not match their viewpoint, and are isolated in a "Bubble" of their own ideas and values.

¹⁷ An "Echo Chamber" is a group of people with the same opinion who come together and reinforce their opinions, making them believe that their own opinions are infallible. This is a phenomenon in which people become unable to experience diverse viewpoints.

As the tendency for citizens to obtain information from the internet increases, the problem of the circulation and spread of dis-/mis-information online is also expanding¹⁸. With the further advancement of AI, there is a possibility that AI will present more pinpointed information, potentially exacerbating the bias in the information users receive¹⁹. Moreover, the issue of fake advertisements (socalled "Fake Ads" with impersonation) misusing the photos and names of celebrities on social media has become a problem, making the healthiness of information circulation in the digital space an urgent issue.

The MIC has been addressing these issues by amending the Act on the Limitation of Liability for Damages of Specified Telecommunications Service Providers and the Right to Demand Disclosure of Identification Information of the Senders (Act No. 137 of 2001)²⁰ to establish new judicial procedures (non-contentious case procedures) for the disclosure of sender information. In 2024, further amendments were made to require platform operators to expedite deletion responses and increase transparency in their operations, with the amendments enacted in May 2024. The title of the law was also changed to the "Act on Measures for Addressing Rights Infringements, etc., Arising from Information Distribution via Specified Telecommunications" (abbreviated as the Information Distribution Platform Measures Act).

Additionally, to ensure the healthiness of information circulation in the digital space, a new "Study Group on Ensuring the Healthiness of Information Circulation in the Digital Space²¹" was launched in November 2023, taking into account international trends and aiming to comprehensively address the circulation and spread of dis-/mis-information, including institutional measures.

(2) Efforts to improve literacy

As mentioned in the previous section, improving the literacy of citizens who receive information is a crucial element in combating dis-/mis-information. The advent of generative AI has highlighted the urgent need for further literacy updates and continuous reviews.

In Japan, efforts have primarily focused on creating a safe internet environment for young people, emphasizing the prevention of internet troubles and promoting the avoidance of risks associated with ICT use. As the use of ICT and digital services becomes commonplace, it is increasingly important for all generations to learn about the characteristics of digital services, the responsibilities associated with behavior on these services, and how to accept, utilize, and disseminate information in an active and interactive manner. This study group is discussing the basic principles for ensuring the healthiness of information circulation in the digital space, the roles and responsibilities expected of various stakeholders, and specific measures. In May 2024, the group compiled and published a "Collection of Multi-Stakeholder Initiatives on Countermeasures Against Dis-/mis-information on the Internet" to facilitate easy reference among a wide range of stakeholders from the public, private, and academic sectors and to promote cooperation and collaboration both domestically and internationally. Moving forward, the MIC plans to conduct follow-up hearings with platform operators and advertising-related organizations, including responses to requests made to platform operators related to the Noto Peninsula Earthquake. Based on these hearings, the MIC aims to ensure the transparency and accountability of platform operators' efforts, promote factchecking, raise awareness, improve literacy, develop human resources, ensure the reliability of information providers, conduct research and development and verification of technologies, address issues related to digital advertising, and strengthen international cooperation. The MIC plans to publish a summary of these measures around the summer of the same year.

Furthermore, in FY2024, the MIC plans to promote the social implementation of countermeasure technologies by inviting applications for technology development entities through the "Development and Demonstration Project for Countermeasure Technologies Against Dis-/ mis-information on the Internet,"²² which aims to address the risks of the circulation of dis-/mis-information on the Internet, including those caused by generative AI.

Since November 2022, the MIC has been holding the "Study Group on Improving Literacy for ICT Utilization" (Chair: YAMAMOTO Tatsuhiko, Professor at Keio University Law School). This group has been discussing and examining the literacy required in the upcoming digital society and the promotion measures for improving literacy. In June 2023, they created and published a roadmap outlining the items to be addressed in the future. The roadmap organizes the direction of short-term and medium- to long-term efforts. In FY2023, as a short-term initiative, they organized the necessary competencies for improving literacy for ICT utilization and developed learning content to address issues common to a wide range of generations.

- ¹⁸ According to a survey conducted by the MIC in FY2023, approximately half of the respondents (48.0%) said they saw dis-/mis-information on SNS "at least once a week." (Awareness survey regarding dis-/mis-information in Japan and abroad in FY2023 https://www.soumu.go.jp/main_content/000945550.pdf>)
- ¹⁹ Based on an interview with Professor HEIWA Hiroshi, College of Liberal Arts, J.F. Oberlin University (conducted on March 8, 2024).
- ²⁰ This is a law that clarifies the requirements for limiting the liability for damages of providers, etc., in cases where rights are infringed by the circulation of information on the Internet, and also establishes the right to request the disclosure of sender information from providers.
- ²¹ Holding of a "Study Group on Ensuring the Healthiness of Information Circulation in the Digital Space" (press release) https://www.soumu.go.jp/menu_news/s-news/01ryutsu02_02000374.html
- ²² MIC "Development and demonstration project of technology to counter dis-/mis-information on the Internet" https://www.soumu.go.jp/main_sosiki/joho_tsusin/d_syohi/taisakugijutsu.html>

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(3) Human resource development in the era of generative AI

As discussed in Chapter 3, the advent of generative AI has had a significant impact on social and economic activities, causing transformations in various business domains. It has been pointed out that "not only in the field of research and development but also in business, basic knowledge is necessary for management to make appropriate investment decisions to promote transformation through the use of generative AI." Knowledge about the amount of data and computational resources required to build foundational models, the differences between traditional information processing and those requiring foundational models or deep learning, and the appropriate use of technology is essential for management across all industries. Without this knowledge, there is a risk of making substantial investments in unnecessary areas due to misleading promotional claims. Therefore, it is suggested that educational materials to acquire basic knowledge are important for all business sectors, including management²³.

The "Study Group on Human Resource Development Policy in the Digital Age," which has been held by the METI since February 2021, has been discussing the "Impact of Generative AI on Digital Human Resource Development" as a major topic for FY2023. In August 2023, they compiled the "Concept of Human Resources and Skills Necessary for Promoting DX in the Era of Generative AI." This report identifies the following skills as necessary literacy levels in the era of generative AI: (1) digital literacy, including a mindset and stance to continue learning proactively without fearing environmental changes, ethical considerations, and systematic understanding of knowledge; (2) proficiency in instructions (prompts), ability to articulate, and communication skills; and (3) the ability to formulate questions, hypothesize, and verify through experience. In response, the METI reviewed the "DX Literacy Standard (DSS-L)" (established in March 2022), which defines the knowledge and skills that all business persons involved in DX should acquire. They added descriptions related to the mindset and stance necessary for the appropriate use of generative AI, as well as understanding the basic mechanisms, technological trends, usage methods, and associated risks. The discussion will be continued on new issues brought about by the advancement of generative AI.

3. Realization of communication network which is a foundation of digital technologies

(1) Efforts toward the realization of Beyond 5G

With the explosive proliferation of AI and the expanded use of digital technologies such as robots, there is an increasing demand for instantaneous processing and decision-making. This, in turn, raises the requirements for low latency, reliability, and robustness in information and communication networks. Additionally, ideas such as "AI Constellations," which function by distributing and interlinking small-scale AIs, have been proposed. To realize such functionalities, the sophistication of network capabilities may be necessary. Furthermore, the integration and unified operation of computational resources like data centers and edge computing with networks are expected to advance further.

Moreover, as data necessary for AI learning and enhancement is generated and circulated in various societal settings, there is a potential for increased communication traffic and a corresponding rise in power consumption. According to Mitsubishi Research Institute, considering the widespread practical application of AI-driven avatars and robots by the 2030s, the volume of data circulation in 2040 is projected to increase 348 times compared to 2020 (Figure 1-6-1-1).



Figure 1-6-1-1 Increase in the data traffic in the age of Beyond 5G

(Source) Mitsubishi Research Institute "Avoiding the triple whammy of ICT infrastructure"24

²³ Interview with Professor KAWAHARA Yoshihiro, Graduate School of Engineering at the University of Tokyo (conducted on March 19, 2024)
²⁴ https://www.mri.co.jp/knowledge/mreview/202307.html

To address the increase in data communication traffic and the associated rise in power consumption, and to further the use of digital technology, the realization of Beyond 5G, which enables real-time and large-capacity data transmission while minimizing power consumption, is essential. Beyond 5G aims to further enhance the features of 5G, such as high speed, large capacity, low latency, and massive simultaneous connections. Additionally, it is expected to address the increased power consumption of networks due to the rise in communication traffic driven by the recent trends of remote and online activities, and to realize new functionalities such as scalability, network safety, reliability, and autonomy. The all photonics network technology, which leverages Photonics-Electronics Convergence technology to achieve high-speed networks with significantly reduced power consumption, is also gaining attention.

In September 2021, the MIC consulted the Information and Communications Council on "The Strategy for Information and Communication Technology Toward Beyond 5G - Aiming for a Resilient and Vibrant Society in the 2030s." In June 2022, an interim report was received. The interim report outlined the envisioned network for Japan, key technological areas such as all photonics network technology, non-terrestrial network

(2) Realization of communication networks for autonomous driving

The realization of advanced autonomous driving is expected to contribute significantly to addressing various social issues such as population decline, aging demographics, and industrial hollowing, by ensuring local transportation and addressing the shortage of truck drivers for logistics. In advanced autonomous driving, communication tailored to specific use cases, such as (NTN) technology, and secure virtualized and integrated network technology, and the strategic direction for promoting research and development, social implementation, intellectual property, standardization, and overseas expansion in an integrated manner. Following the interim report, the permanent research and development fund for the NICT has been fully operational, and discussions on the utilization of all photonics networks by public and private institutions have progressed. Internationally, various efforts in research and development and international standardization aimed at capturing the Beyond 5G market have expanded. In light of these developments, the Information and Communications Council resumed discussions in November 2023, with the final report scheduled for June 2024.

The final report is expected to state that AI will not only be used as a tool for efficiently analyzing vast amounts of data collected from the physical world in a tool optimizing the operation of information and communication networks (AI for Network) and CPS (Cyber Physical System) but also that information and communication networks will function as the foundation supporting a society where AI is utilized ubiquitously, essentially an "AI society" (Network for AIs).

updating autonomous driving maps using mobile phone networks, remote monitoring and control, and vehicle-to-vehicle/road-to-vehicle communication for sharing local and road conditions and traffic information, is essential. Efforts are being made to build communication networks for the realization of autonomous driving (Figure 1-6-1-2).



Figure 1-6-1-2 Image of telecommunication needed for autonomous driving

(Source) MIC(2023) Interim report of the study group on "Next-generation ITS communication in the era of autonomous driving"

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In Japan, the "Comprehensive Strategy for the Vision for a Digital Garden City Nation (Revised Edition 2023)" aims to promote regional transportation through autonomous driving and sets a goal to realize unmanned autonomous driving mobility services in approximately 50 locations by FY2025 and in over 100 locations by FY2027, with relevant government ministries and agencies collaborating. Additionally, the "Comprehensive Plan for National Development of Digital Lifelines" by the METI includes the establishment of support roads for autonomous driving services as one of the Early Harvest Projects. It aims to set up lanes prioritizing autonomous driving vehicles for over 100 kilometers on certain sections of the Shin-Tomei Expressway by FY2024, with the goal of realizing the operation of Level 4 autonomous driving trucks, and to enable the provision of autonomous driving vehicle mobility services in 50 locations nationwide by FY2025 and in 100 locations nationwide by FY2027.

Regarding the consideration and establishment of communication standards necessary for the realization of autonomous driving, collaborative efforts between industry, academia, and government have been ongoing since 2014 under the Strategic Innovation Promotion Program (SIP) for Autonomous Driving by the Cabinet Office. In 2022, the "Cooperative Autonomous Driving Communication Method Roadmap" was formulated. This roadmap outlines the use cases related to autonomous driving, indicating "the utilization of existing ITS radio (760MHz band) for early use cases" and "the need for new communication methods (5.9GHz band) around 2030 for mediation and negotiation by around 2040". In response, the MIC held the "Study Group on Next-Generation ITS Communication for the Autonomous Driving Era" from February 2023. The group discussed the following topics: (1) use cases assuming the utilization of "next-generation ITS communication," (2) strategies for integrating V2X communication with mobile networks (V2N communication), (3) allocation policies for the 5.9GHz band for V2X communication and the direction of the implementation roadmap, and (4) challenges for implementation and other promotion strategies. In August of the same year, it published an interim summary stating "the consideration of allocating a maximum 30MHz bandwidth for V2X communication in the 5,895-5,925MHz band, taking into account international frequency harmonization and interference with existing radio stations". In the future, the "short-term tasks" identified in the interim summary, such as "in-depth exploration of use cases for 5.9GHz band V2X communication, consideration of communication methods and expansion strategies," "technical examination of 5.9GHz band V2X communication systems with adjacent systems (broadcasting, wireless LAN, ETC, etc.) (frequency sharing examination)," and "examination of measures to promote frequency migration for broadcasting wireless stations," will be pursued. Furthermore, with the aim of early implementation of 5.9GHz band V2X communication, the MIC allocated 20.5 billion yen in the supplementary budget for FY2023 for the promotion of digital infrastructure development for the implementation of autonomous driving, and plans to work with relevant ministries and agencies to conduct verification of autonomous driving trucks on the Shin-Tomei Expressway and other activities.

Additionally, to ensure the reliability of communication systems necessary for safe and efficient autonomous driving, the MIC is conducting verifications under the "Regional Digital Infrastructure Utilization Promotion Project (Autonomous Driving Level 4 Verification Type)" and plans to develop a model collection that regions considering the introduction of autonomous driving can refer to by around FY2024, based on the results of these verifications. This model collection aims to support the development of regional information and communication environments necessary for ensuring the reliability of communication systems during the implementation of autonomous driving.

4. Creation and application of rules and international cooperation to ensure safe, secure and reliable use

With the advancement of AI, it is anticipated that the risks and challenges posed by digital technologies will become more severe. Therefore, the establishment and adherence to rules regarding AI governance and regulation, in coordination with international efforts, are indispensable. As mentioned in Chapter 4, Japan has already formulated AI Business Operator Guidelines and is conducting awareness activities to ensure that these guidelines are widely known and voluntarily adhered to by private businesses. Alongside the implementation of these AI Business Operator Guidelines, the government, centered around the AI Strategic Council, plans to continue examining the overall framework of regulations²⁵.

Furthermore, it is essential to strengthen cooperation and collaboration in multilateral forums such as the G7, the OECD, the GPAI, and the United Nations. Regarding the Hiroshima AI Process, which was initiated at the G7 summit in May 2023, Japan, as the chair country, led intensive discussions among G7 countries. By December of the same year, an agreement was reached on the "Hiroshima AI Process Comprehensive Policy Framework," the first international policy framework aimed at addressing advanced AI systems such as generative AI, and the "Work Plan to advance the Hiroshima AI Process," which outlines future G7 initiatives. The impor-

²⁵ "AI Strategy Issues and Responses" (May 22, 2024, 9th AI Strategic Council Materials 1-1) https://www8.cao.go.jp/cstp/ai/ai_senryaku/9kai/ shiryo1-1. pdf

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tance of interoperability between AI governance frameworks was emphasized within these agreements. Italy, the G7 chair country for 2024, has expressed its commitment to the continued promotion of the Hiroshima AI Process. The "G7 Industrial, Technology, and Digital Ministerial Declaration" adopted in March 2024 welcomed actions to promote the dissemination, adoption, and application of the Hiroshima AI Process outcomes among key partner countries and organizations, including developing and emerging economies.

Additionally, at the OECD Ministerial Council Meeting held in Paris in May 2024, where Japan served as the chair, Japan contributed to the revision of the "OECD AI Principles" adopted in 2019, based on the outcomes of the Hiroshima AI Process. Concurrently, at a side event on generative AI, Prime Minister Kishida announced the establishment of the "Hiroshima AI Process Friends Group," a voluntary framework of countries and regions that support the spirit of the Hiroshima AI Process, with participation from 49 countries and regions. Minister of Internal Affairs and Communications Matsumoto stated, "by leading the creation of international rules for AI, Japan will enhance the reliability of its business environment and promote investment in Japan. We aim to achieve Japan-centered standardization in the digital field."^{26,27} He further plans that Japan will continue to work on implementing international guidelines and cooperate to ensure that people worldwide can use AI safely, securely, and reliably.

²⁶ Minutes of the 5th Economic and Fiscal Policy Council 2024 (May 10, 2024) https://www5.cao.go.jp/keizai-shimon/kaigi/minutes/2024/0510/gijiyoushi.pdf>

²⁷ KASHIBA Sakura, "Microsoft invests 2.9 billion dollars to strengthen Japan's AI and cloud infrastructure, advancing Japan-U.S. cooperation in the AI field", "JETRO Business Brief" April 16, 2024, https://www.jetro.go.jp/biznews/2024/04/34ae6386dcb01c5b.htm

Column Towards a future of collaboration and coexistence with Al and robots (convivial relationships)

(1) Future scenarios of AI

At the second AI Strategic Meeting held in May 2023, Professor KAWAHARA Yoshihiro, Graduate School of Engineering at the University of Tokyo, presented future scenarios for AI (Figure 1). These scenarios predict that multimodal capabilities will be realized within 3-4 years, and that in 5-10 years, generative AI will be integrated into robots, thereby acquiring physicality. Concurrently, the misuse of AI is rapidly advancing, necessitating measures against social disruption caused by cyberattacks and disinformation, as well as the adverse effects of monopolies by large corporations.



(Source) 2nd AI Strategy Meeting, Material 2-3 by member KAWAHARA (May 26, 2023)

Considering these future scenarios and risks, it is essential to engage in comprehensive discussions that address not only technological aspects but also ethical and social issues. With the rapid development and proliferation of generative AI, efforts to analyze and seek solutions for the potential risks and challenges (Ethical, Legal, and Social Issues: ELSI) posed by AI technologies and systems to individuals and society have become more active.

The "Principles for a Human-Centric AI Society," published in March 2019, established three fundamental principles:

1. A society that respects human dignity (Dignity)

(2) Convivial relationships with AI and robots

In building the future society, it is important not to overly depend on technologies like AI, but to balance the potential and risks brought by technological advancements while focusing on human-centered happiness. The concept of conviviality, proposed by Austrian philosopher Ivan Illich in his 1973 book "Tools for Conviviality," is relevant here. Illich described two critical junctures: the "First Watershed," where technology emerges and spreads, enhancing human freedom, and the "Second Watershed," where people begin to be subjugated by technology, losing their freedom. He emphasized the

- 2. A society where people from diverse backgrounds can pursue diverse forms of happiness (Diversity and Inclusion)
- 3. A sustainable society (Sustainability)

Additionally, the "AI Guidelines for Business," published in April 2024, emphasize "Human-centric" actions as the primary directive for all stakeholders, stating that "it is crucial for AI to enhance human capabilities and enable the pursuit of diverse forms of happiness (wellbeing) for various individuals". The guidelines also highlight the need to address the risks of over-reliance on AI, such as automation bias, which refers to the excessive trust and dependence on automated systems and technologies in human judgment and decision-making.

importance of remaining between these two watersheds.

Professor OKADA Michio of Toyohashi University of Technology, who promotes research on "Weak Robots" that coexist with humans, advocates for a convivial relationship with AI and robots. This relationship should involve a gentle mutual dependence that does not undermine each other's autonomy, allowing both human and robotic capabilities to be fully utilized and enhancing well-being. He proposes "Convivial Robotics," where robots and humans enjoy a harmonious coexistence.

For example, in the context of mobility, the introduc-

tion of bicycles expanded human capabilities (the first watershed), but the advent of cars and fully autonomous vehicles may lead to a sense of passivity, where individuals feel like "Cargo" rather than active participants (the second watershed).





Figure 3 Intolerance by "Creeping Featurism"



(Source) Professor OKADA Michio provided material

Traditional product and service development often follows an "Additive" approach, continuously adding functions, which cognitive scientist Donald Norman referred to as "Creeping Featurism." However, excessive pursuit of functionality and convenience can undermine user autonomy, increase demands, and lead to a costly and exhausting arms race for providers. In education and learning, excessive passivity can hinder rich learning experiences, and in welfare and caregiving, it can lead to the deterioration of physical functions in care recipients.

Conversely, for example, in the case of widely accept-

ed cat-shaped serving robots in restaurants nationwide, customers accept the imperfection of having to serve the food brought to the table by themselves and are seen to cooperate lively, even yielding the way for the robot. In this example, without incurring significant costs to add a serving function to the table, the purpose is achieved within a symbiotic relationship between the service provider and the recipient, creating a natural state of happiness for the robot manufacturer, the restaurant, and the customers, transcending the boundaries between them.

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Figure 4 Social implementation of "Weak Robot" in educational field



(Source) Professor OKADA Michio provided material