Tentative

Translation

Report 2021

Promoting “Safe, Secure, and Trustworthy Implementation of AI in Society”

4 August 2021

The Conference toward AI Network Society

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Introduction

Artificial Intelligence (AI) has been used in more scenes of our lives. AI is also increasingly used for production and service provision in corporate activities. Social implementation of AI is progressing.

Since October 2016 the Ministry of Internal Affairs and Communications (MIC) has been holding the Conference toward AI Network Society ("the Promotion Council") to discuss social, economic, ethical and legal issues regarding AI networking. Results of the discussions were compiled and released as "Draft AI R&D Guidelines for International Discussions" in July 2017, "Draft AI Utilization Principles" in July 2018 and "AI Utilization Guidelines" in August 2019. Later, under the theme: "Safe, Secure, and Trustworthy Implementation of AI in Society"[1] the Conference conducted hearings of stakeholders[2] including AI developers, service providers, business users and consumer users. The results of the activities were released as "Report 2020" in July 2020.

The G7 ICT Ministers' Meeting in Takamatsu, Kagawa, held in Japan in April 2016 triggered active international discussions at G7 and OECD (Organization for Economic Co-operation and Development). OECD adopted "Recommendation of the Council on Artificial Intelligence" in May 2019, which was followed by the adoption of the "G20 AI Principles" at G20 in June of the same year. OECD is conducting studies toward information sharing and social implementation of AI-related initiatives. International discussions on AI ethics and governance are made at the Global Partnership on AI (GPAI)[3] and the United Nations Educational, Scientific and Cultural Organization (UNESCO) as well.

In Japan, the "Fifth Science and Technology Basic Plan" (Cabinet Decision on January 22, 2016)[4] advocated for "Society 5.0[5]" that is a human-centered society where high integration of cyberspace (virtual space) and physical space (real space) can promote economic development and solve social issues, as the future society Japan should aim for. The Sixth Science, Technology and Innovation Basic Plan (Cabinet Decision on March 26, 2021)[6] states: For the realization of Society 5.0, in order to create new value by combining cyber space and physical space, we aim to transform into a society that creates a dynamic virtuous cycle that constantly changes. In this way, a digital twin with high-quality and diverse data is created in cyber

[1] What "secure" means depends on subjective judgement of the individual, but it requires confidence building as a prerequisite. Here, the term refers to a state where confidence is built while safety is ensured at a socially agreed level. The term "safe" refers to a state where it is objectively judged that there is no damage to life, body or property (based on the descriptions in Chapter 2 of the Report of the "Conference on science and technology policies contributing to development of a safe and secure society" of the Ministry of Education, Culture, Sports, Science and Technology). "Principle of Safety" of the "Draft AI Utilization Guidelines for International Discussions" and the "AI Utilization Guidelines" provides "Users should take into consideration that AI systems or AI services in use will not harm the life, body, or property of users or third parties through actuators or other devices."

[2] For the classification of stakeholders, sea "AI Utilization Guidelines"

[3] GPAI is an international public-private collaboration organization established in June 2020 by governments, international organizations, industries, experts and other parties who have common values concerning the development and utilization of "responsible AI" based on a human-centered approach. Participants include Japan, Australia, Brazil, Canada, France, Germany, India, Italy, South Korea, Mexico, Holland, New Zealand, Poland, Singapore, Slovenia, Spain, the United Kingdom, the United States and EU.

[4] Available on the following website:
<https://www8.cao.go.jp/cstp/kihonkeikaku/5honbun.pdf>

[5] System that combines cyber space (virtual space) and physical space (real space) is called "Cyber Physical System: CPS."

[6] Available on the following website:
<https://www8.cao.go.jp/cstp/kihonkeikaku/6honbun.pdf>

space, and physical space is changed based on this digital twin while actively using AI, and the results are reproduced in cyber space.[7]

In order to promote "Safe, Secure, and Trustworthy Implementation of AI in Society" in this context, after releasing the Report 2020, the Promotion Council (including the AI Governance Review Committee) continued to gather and accumulate practical examples of initiatives for implementation of AI in society through hearings of stakeholders including AI developers, service providers and business users. Thinking that AI can play a considerable role against the spread of COVID-19, we have considered AI utilization for this purpose.

This report overviews the domestic and overseas trends and international discussions on AI networking and surveys AI utilization in the light of the spread of COVID-19, while attempting an international comparison of AI utilization. In addition, while introducing practical examples gathered through hearings of researchers, business operators and others who are making advanced or ambitious efforts on implementation of AI in society, the report also summarizes future initiatives.

The initiatives introduced in this report are shown in the table below.

○ Prof. Yasushi Okuno (Kyoto University Graduate School)	: Challenge of developing COVID-19 treatments using the supercomputer "Fugaku" and AI
○ Prof. Yasushi Okuno (Kyoto University Graduate School)	: Challenge of developing COVID-19 treatments using the supercomputer "Fugaku" and AI
○ Fujitsu Laboratories Ltd.	: Fujitsu's AI Research Activities in the New Normal
○ Google LLC	: Putting AI Principles into practice
○ National Institute of Information and Communications Technology	: Large-scale natural language processing technology aimed at solving social issues
○ NEC Corporation	: Toward a safe, secure, and trustworthy implementation of AI in society
○ NTT Communications Corporation	: Smart World realized by communication AI
○ Prof. Hidenori Kawamura (Hokkaido University Graduate School)	: Research case study and start-up at the Laboratory of Harmonic Systems Engineering, Hokkaido University
○ Institution for a Global Society Co., Ltd.	: Protection of personal information that accelerates data-based education with fair evaluation by AI. Human resources development and an education platform
○ Aizuwakamatsu City	: The role of AI in "Smart City Aizuwakamatsu"
○ NTT DATA Corporation	: NTT DATA Group AI Governance Initiatives, 2021 update
○ Oki Electric Industry Co., Ltd.	: AI Risk Management of OKI
○ Sony Group Corporation	: Sony Group's AI Ethics Activities
○ Sumitomo Corporation	: DX Promotion and AI Utilization in the COVID-19 crisis by Sumitomo Corporation
○ LegalForce, Inc.	: Introduction of a contract review and management system using

[7] The Promotion Council advocates Wisdom Network Society (WINS) as an ideal society to aim for through AI networking and holds up "harmony of physical space and cyberspace" as the basic principle for the formation of WINS. It states: "enable collaboration beyond differences of spaces between people, physical things and events by connecting and harmonizing physical space and cyberspace through AI networks." See pp.15-16 of the Interim Report (April 2016) and Note 43 of the Report 2016 (June 2016) compiled by the AI Networking Review Conference and; pp.7-8 of the Report 2017 (July 2017) and PP8-9 of the Report 2018 (July 2018) compiled by the Promotion Council.

	natural language processing
○ Legalscape, Inc.	: Efforts toward organizing legal information into web-like structure
○ Nippon Television Network Corporation	: Introducing the AI utilization case study and AI utilization promotion system of Nippon TV
○ NHK Science & Technology Research Laboratories	: Efforts to develop AI technology at NHK Science & Technology Research Laboratories
○ Toshiba Corporation	: Toshiba's AI Initiatives
○ FUJIFILM Holdings Corporation	: Regarding Fujifilm's AI development and application case studies and establishment of a basic AI policy
○ Japan Post Holdings Co., Ltd.	: Efforts to utilize technology in the postal and logistics fields
○ Stella Place Co., Ltd.	: Development of the AI weather prediction model in high-performance computing and the possibility of its application at the PC level
○ IBM Japan, Ltd.	: IBM Data and AI technologies to support enterprise-wide AI adoption
○ Hitachi, Ltd.	: Efforts toward the realization of an AI network society

With cooperation of the researchers, business operators and others listed above, this report could compile a large number of specific initiatives regarding implementation of AI in society. These examples are believed to provide very useful and valuable information for people who are working on development or utilization of AI or considering such activity.

We give thanks to the researchers and business operators who cooperated and hope that this report will be shared by many stakeholders and contribute to promotion of AI development and utilization toward further promotion of "Safe, Secure, and Trustworthy Implementation of AI in Society."

Chapter 1 Recent Trends in AI Networking

Because it is important to form a consensus with the stakeholders in studies regarding AI, the Promotion Council conducted study based on the domestic and overseas trends and the trends of international discussions on AI networking. This Chapter focuses on the overview of the trends of AI networking after the release of the "Report 2020."[8]

1. Domestic Trends

(1) AI Strategy 2021 (Follow-up to "AI Strategy 2019")

The following items were included in the AI Strategy 2021 (Follow-up to "AI Strategy 2019" [9]) decided by the Integrated Innovation Strategy Promotion Council on June 11, 2021).[10] The Council also decided to formulate a new AI strategy within 2021.

- Establishing seven "Social Principles of Human-Centric AI" for the social framework of an AI-ready society in Japan.
- Build a multilateral framework pertaining to social principles of AI, which includes studies toward prevention of ethics dumping.
- Display initiative in GPAI toward promotion of responsible AI and innovations.
- In order to implement the AI social principles, we will consider the ideal form of AI governance in Japan, such as regulations, standardization, guidelines, audits, that can contribute to strengthening Japan's industrial competitiveness and improving the social acceptance of AI, while keeping an eye on domestic and international trends.

(2) Council of Social Principles of Human-Centric AI

The Cabinet Office has re-established the "Council of Human-Centered AI Social Principles" and held the first and second meetings of FY2020 on December 24, 2020 and May 24, 2021, respectively and the first meeting of FY2021 in May 12, 2021.

In the past meetings, reporting and presentations on the domestic and international AI trends were made by members and opinions were exchanged on issues to be discussed at the Council, points to be borne in mind during discussions, and the future of AI regulations.

(3) Expert Group on Architecture for AI Principles to be Practiced and the Expert Group on How AI Principles Should be Implemented

The Ministry of Economy, Trade and Industry (METI) set up the Expert Group on Architecture for AI Principles to be Practiced in June 2020 and has been studying optimal AI governance from the perspective of business practice in order to promote implementation of AI in society. The group summarized domestic and overseas trends on AI governance and compiled "AI Governance in Japan ver.1.0 (Interim Report by the Expert Group on Architecture for AI Principles to be Practiced)" as the desirable state of AI governance in Japan. The report was published on January 15, 2021 and comments were solicited until February 13 of the same year. Later, Expert Group on How AI Principles Should be Implemented was set up to succeed the former in May of the same year. The interim report was modified based on the

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[8] For the trends of AI networking before the release of the "Report 2020," see Chapter 1 of the "Report 2020". For the trends of domestic, overseas and international discussions, in particular, see Chapter 2, 2.

[9] "AI Strategy 2021" was decided by the Integrated Innovation Strategy Promotion Council on June 11, 2021.

[10] Available on the website below:
<https://www8.cao.go.jp/cstp/ai/aistrategy2021_honbun.pdf>

discussions of the new expert group, comments were solicited and the final report was released on July 9 of the same year.[11]

With the aim of promoting implementation of AI in society, the final report proposes formulation of intermediate and practical guidelines for realization of goal-based governance. The report summarizes the proposal as follows: (i) Creation of a foundation for use of AI: Dissemination of activities throughout the company, raising awareness of AI governance, and improving AI literacy; (ii) Development/introduction of AI systems: Development of principles, creation of a management framework, establishment of an escalation process, development of a risk management process, and; (iii) Operation of AI systems: Monitoring, internal audits, use of external evaluation, development of relationships with stakeholders, improvement and progress management.

METI at the Expert Group on How AI Principles Should be Implemented studied horizontal and intermediate rules shown in the interim report and the final reports above, compiled and published "Governance Guidelines for Implementation of AI Principles Ver. 1.0" on July 9, 2021, and opened a call for public comments until September 15 of the same year.[12]

(4) The Installment Sales Act that enables utilization of AI for examination of the credit use limit

The Act for Partial Revision of the Installment Sales Act submitted to the 201st Diet was enacted on June 16, 2020 (the Act No.64 of 2020 enforced on April 1, 2021) and the Installment Sales Act (Act No.159 of 1961) was revised accordingly.

The revision established a system where the Minister of METI authorizes new methods to use AI and big data for examination of the use limit when issuing a credit card, etc. Authorized credit card businesses may replace the conventional survey of the estimated payable amount using uniform formulas based on annual income, etc. with the authorized examination method. In addition, a system was established to register credit card businesses with a use limit not over 100,000 yen. These businesses can conduct use limit examination using the registered examination method instead of the conventional survey of estimated payable amount as in the case of the authorized business operators.

(5) Machine Learning Quality Management Guideline

With the aim of enabling providers of products using AI to evaluate and improve the quality in order to reduce accidents and/or economic losses caused by AI malfunctions, the National Institute of Advanced Industrial Science and Technology formulated and published the "Machine Learning Quality Management Guideline" on June 30, 2020. [13]

The guideline covers quality management over the entire lifecycle of AI systems and systematically compiles initiatives and inspection items necessary to satisfy quality requirements for service provision of AI systems. Specifically, necessary quality when using an AI system is defined as "quality in use," quality required for the machine learning component in the AI system is defined as "external quality" and the characteristics unique to machine learning component are defined as "internal quality." Based on this classification, external quality reaches the necessary level with the improvement of internal quality and

[11] Available on the website below:
<https://www.meti.go.jp/shingikai/mono_info_service/ai_shakai_jisso/2021070901_report.html>
[12] Available on the website below:
<https://www.meti.go.jp/shingikai/mono_info_service/ai_shakai_jisso/2021070902_report.html>
[13] Available on the website below:
<https://www.aist.go.jp/aist_j/press_release/pr2020/pr20200630_2/pr20200630_2.html>

eventually quality in use is realized in the end product.

The second edition of the guideline was published on July 5, 2021.[14] The changes include specific description of the definition of fairness and addition of a new chapter describing quality management regarding fairness and considerations regarding security.

(6) Guidelines on Assessment of AI Reliability in the Field of Plant Safety

The Fire and Disaster Management Agency (MIC), the Ministry of Health, Labour and Welfare and METI compiled and released the “Guidelines on Assessment of AI Reliability in the Field of Plant Safety” and the "Collection of Case Examples of Leading Companies Introducing AI into Plants" on November 17, 2020, with the aim of contributing to solving problems faced when introducing AI in the field of plant safety (revised on March 30, 2021).[15]

The guidelines present the approaches to proper evaluation of AI reliability (delivering the expected quality for safety and productivity improvement), particularly for the field of plant safety. The collection compiles successful introduction cases of AI and how to overcome problems of introducing AI based on success cases in plant businesses

(7) Guidelines for Quality Assurance of AI-based Products and Services

Consortium of Quality Assurance for Artificial-Intelligence-based products and services (QA4AI Consortium) published the Guidelines for Quality Assurance of AI-based Products and Services 2020.08 version (revised version) on August 1, 2020 as common guidelines regarding quality assurance for appropriate use and timely release of AI products[16].

First, the guidelines focus on the characteristics of the organizations developing and using AI technologies/products, and then identify issues for quality assurance of AI products. The guidelines present five axes to be considered in quality assurance and evaluation of AI products: Data integrity; Model Robustness; System Quality; Process Agility, and Customer expectation, discuss their balance and list technologies to promote each of them.

(8) AI Governance Ecosystem

The Japan Deep Learning Association thinks that in Japan where the industrial structure of AI services has a very long supply chain, it is important to construct AI governance ecosystem that transcends organizations, and thus released a report titled “AI Governance Ecosystem” on July 21, 2021.[17]

The report makes the following three recommendations:

- The principles and practices should be developed with a view to establishing an “AI governance ecosystem” that works with external contexts such as auditing, insurance, standardization, third-party committees.
- The principles and practices of AI governance should also be considered from the perspective of a long

[14] Available on the website below:
<https://www.digiarc.aist.go.jp/publication/aiqm/guideline-rev2.html>

[15] Available on the website below:
<https://www.meti.go.jp/press/2020/03/20210330002/20210330002.html>

[16] ”AI Product Quality Assurance Guidelines 202008 version”
Available on the website below:
<http://www.qa4ai.jp/download/>
The first edition was released in May 2019 and the first revised edition was released in February 2020.

[17] Available on the website below:
<https://www.jdla.org/document/>

supply chain that includes B2B companies.

・We should organize cultural and policy issues and debates on a national level, as Japan, and disseminate practical examples to the international community.

2. Overseas Trends

(1) European Commission

(i) WHITE PAPER On Artificial Intelligence

The European Commission invited comments on the WHITE PAPER On Artificial Intelligence[18] published on February 19, 2020 until May 10 (extended to June 14) of the same year and published the results on July 17 of the same year.[19] 1,215 comments from around the world were presented.[20] Major concerns of the comments regarding the regulation options include:

・42% of the comments ask for introduction of a new regulation framework

・43% of the comments think that mandatory requirement should be limited to high-risk AI

Based on the results of the invitation and inception impact assessment, it is scheduled to make proposal of a regulation framework sometime early in 2021.[21]

(ii) Assessment List for Trustworthy Artificial Intelligence

High-Level Expert Group on Artificial Intelligence (AI HLEG) that was selected by the European Commission formulated the "Assessment List for Trustworthy Artificial Intelligence (ALTAI)"[22] for self-assessment in April 2019. The group reviewed the list based on the feedbacks from the groups who tried the list and released the final version on July 17, 2020.[23]

Following the seven requirements of the "Ethics Guidelines for Trustworthy Artificial Intelligence"[24] the list consists of the items below:

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[18] "WHITE PAPER On Artificial Intelligence - A European approach to excellence and trust"
Available on the website below:<https://ec.europa.eu/info/publications/white-paper-artificial-intelligence-european-approach-excellence-and-trust_en>
For the outline of the WHITE PAPER On Artificial Intelligence, see Chapter 1, 2. (2) of the Report 2020.

[19] "White Paper on Artificial Intelligence: Public consultation towards a European approach for excellence and trust" Available on the website below:
<https://ec.europa.eu/digital-single-market/en/news/white-paper-artificial-intelligence-public-consultation-towards-european-approach-excellence>

[20] In response to this invitation, members of the Promotion Council and the AI Governance Review Committee submitted their comments.

[21] Based on this, the "Proposal for a regulation Laying down harmonized rules on artificial intelligence" was published on April 21, 2021. See (iii) below.

[22] This was formulated as a part of the "Ethics Guidelines for Trustworthy Artificial Intelligence" compiled by AI HLEG in April 2019. Its first edition was published as a tool for operation of the guidelines in June of the same year.

[23] "THE ASSESSMENT LIST FOR TRUSTWORTHY ARTIFICIAL INTELLIGENCE (ALTAI) for self-assessment"
Available on the website below:
<https://ec.europa.eu/digital-single-market/en/news/assessment-list-trustworthy-artificial-intelligence-altai-self-assessment>

[24] It was compiled by AI HLEG in April 2019. For relation with ALTAI, see the footnote 22 above.

- Human Agency and Oversight;
- Technical Robustness and Safety;
- Privacy and Data Governance
- Transparency;
- Diversity, Non-discrimination and Fairness;
- Environmental and Societal well-being;
- Accountability

(iii) Proposal for a Regulation laying down harmonized rules on artificial intelligence

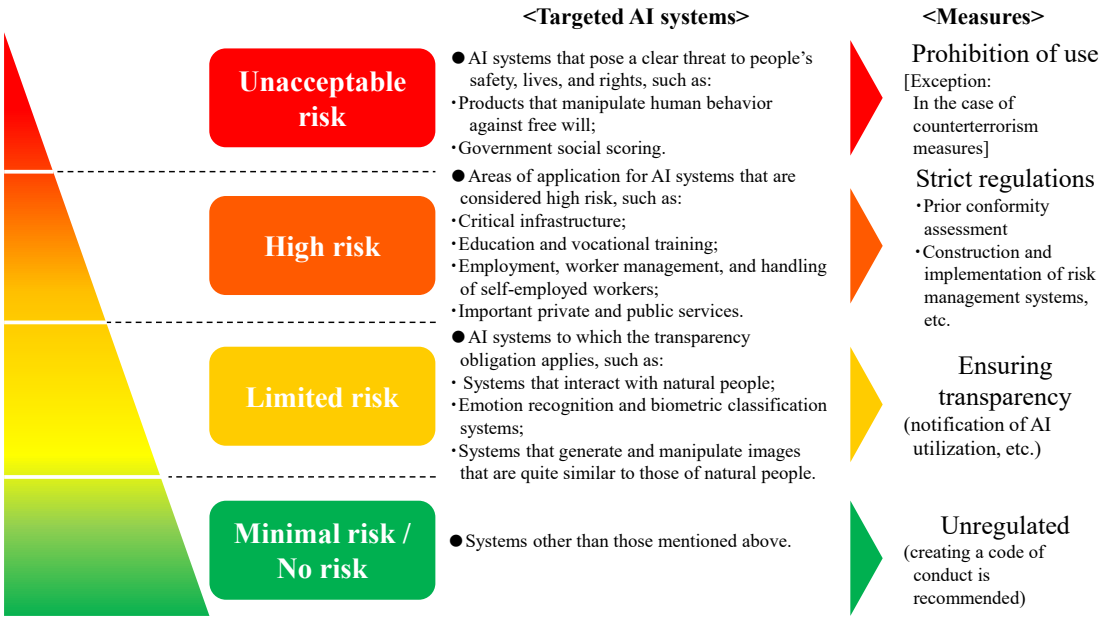
Based on various studies including past white papers on AI, and after conducting the impact assessment, the European Commission published the "Proposal for a Regulation Laying down harmonized rules on artificial intelligence" on April 21, 2021.[25]

The proposal aims to form an ecosystem of trust through a legal framework for reliable AI. The risks of AI systems are classified into four types using a risk-based approach (method to use different measures according to the risk level) based on the purpose and application, and regulations will be introduced according to each risk (see the figure below).

The four policy options of the proposal with different level of regulatory intervention were assessed with focus on economic and social impacts: particularly impact on basic rights. The desirable option was found to be option 3+ (EU's horizontal legislative means based on the proportional risk-based approach and the code of conduct for non-high-risk AI systems).

Proposal for a Regulation Laying down Harmonized Rules on Artificial Intelligence

○ Risks of AI systems were classified into four categories according to a risk-based approach and introduction of regulations according to the risk was proposed.



According to the proposal, providers and users in third countries that launch AI systems in the EU and provide AI system deliverables are also subject to regulations on high-risk AI. For example

- AI system providers are obliged to satisfy requirements, which include: construct, implement,

[25] "Proposal for a Regulation laying down harmonized rules on artificial intelligence"
Available on the website below:
<https://digital-strategy.ec.europa.eu/en/library/proposal-regulation-laying-down-harmonised-rules-artificial-intelligence>

document and maintain a risk management system, and maintain logs automatically generated by their AI systems

- Users are obliged to use the AI system according to the instruction for use and monitor the AI system operation based on the instruction.

The European Parliament and European Council will make deliberations and go through a process of mutual submission of draft amendments in the interval. After agreement of the European Commission, European Parliament and European Council, the proposal will be eventually adopted.

(iv) Initial impact assessment regarding "Civil liability - adapting liability rules to the digital age and artificial intelligence"

In order to address the issues caused by application of responsibility rules in the circular economy that involves frequent repair, recycling and upgrading of artificial intelligence and other new emerging technologies and products, the European Commission presented various policy options including application of the current Product Liability Directive to new products, etc. It released the Inception Impact Assessment[26] on June 30, 2021 and invited feedback until July 28 of the same year.

Regarding AI, the following options were proposed to supplement the proposed regulations of the EU:

- Options to adapt strict liability rules to the digital age and circular economy
  - Revise the Directive to extend strict liability rules to cover intangible products (e.g., digital content/software) that cause physical/material damage
  - Extend strict liability to online marketplaces when they fail to identify the producer.
  - Extend the range of damages for which compensation can be claimed under the Directive to non-material damages (e.g., data loss, privacy infringements or environmental damage).
  - Harmonize the existing strict liability schemes of operators/users that apply to AI-equipped products and providers of AI-based services (where injured parties only have to prove that the damage emanates from the sphere of the operator of the AI-system).
- Other options to address proof-related and procedural obstacles to getting compensation
  - Oblige the producer to disclose technical information to the injured party; alleviate the burden of proof; reverse the burden of proof; ensure producers of products that continuously learn are strictly liable for damage

(2) European Parliament

(i) Framework of ethical aspects of artificial intelligence, robotics and related technologies

The European Parliament adopted the "Framework of ethical aspects of artificial intelligence, robotics and related technologies"[27] on October 20, 2020. This is a proposal regarding guidelines of ethical principles in development, implementation and use of AI, robots and related technologies, which should

[26] Inception Impact Assessment refers to the outline of the issues at the stage of policy development, policy goals and options and assessment of the impacts that are likely to be caused by each option. This assessment is available on the website below:
<https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12979-Civil-liability-adapting-liability-rules-to-the-digital-age-and-artificial-intelligence_en>
It is noted that this does not foresee the final decision of the European Commission.

[27] "Framework of ethical aspects of artificial intelligence, robotics and related technologies"
Available on the website below:
<https://www.europarl.europa.eu/doceo/document/TA-9-2020-0275_EN.html>

be considered in future legislation. The framework requires high-risk AI technologies to be designed under human oversight.

(ii) Civil liability regime for artificial intelligence

The European Parliament adopted the "Civil liability regime for artificial intelligence" on October 20, 2020.[28] This is a proposal regarding guidelines for future-oriented civil liability legal framework and includes application of strict liability to high-risk AI operators for damage. It also stresses the importance of defining a harmonized and clear civil liability regime for provision of legal certainty to stakeholders including producers and operators in order to promote development of AI technologies and products/services using them.

(i) and (ii) above were adopted with a view to their legislation in 2021. The European Parliament also adopted a similarly positioned report "Intellectual property rights for the development of artificial intelligence technologies"[29] on the same day.

(3) European Network and Information Security Agency

The European Network and Information Security Agency released the "AI Threat Landscape Report"[30] on December 15, 2020.

The report suggests that AI may open new avenues for attack methods and bring about new cybersecurity and data protection challenges and presents maps of AI cybersecurity ecosystem and threat landscape.

(4) United Kingdom

The Information Commissioner's Office released the "Guidance on AI and data protection"[31] on July 30, 2020.

The guidance was compiled as part of efforts to realize data protection in AI and includes best practices usable for organizations and recommendations regarding technical measures in order to reduce risks that can be aggravated or generated by AI and other various risks including discrimination and bias.

(5) Germany

(i) German Standardization Roadmap on Artificial Intelligence

The German Institute for Standardization, German Commission for Electrical, Electronic & Information Technologies and The Federal Ministry for Economic Affairs and Energy published the "German Standardization Roadmap on Artificial Intelligence"[32] on November 30, 2020.

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[28] "Civil liability regime for artificial intelligence"
Available on the website below:
<https://www.europarl.europa.eu/doceo/document/TA-9-2020-0276_EN.html>

[29] "Intellectual property rights for the development of artificial intelligence technologies"
Available on the website below:
<https://www.europarl.europa.eu/doceo/document/TA-9-2020-0277_EN.html>

[30] "AI Threat Landscape Report" Available on the website below:
<https://www.enisa.europa.eu/news/enisa-news/enisa-ai-threat-landscape-report-unveils-major-cybersecurity-challenges>

[31] "Guidance on AI and data protection" Available on the website below:
<https://ico.org.uk/for-organisations/guide-to-data-protection/key-data-protection-themes/guidance-on-ai-and-data-protection>

[32] "German Standardization Roadmap on Artificial Intelligence"

The roadmap summarizes the current situation concerning the seven following topics:

- Basic topics
- Ethics/Responsible AI
- Quality, conformity assessment and certification
- IT Security (and safety) in AI systems
- Industrial automation
- Mobility and logistics
- AI in medicine

and mentions the need for standardization. The roadmap is scheduled to be continuously updated considering the changes in the requirements.

(ii) Strategie Künstliche Intelligenz der Bundesregierung

On December 2, 2020, the Federal Government updated the "Strategie Künstliche Intelligenz der Bundesregierung"[33] formulated in November 2018. The update was made to address challenges including fighting against the pandemic, environment/climate protection and development of international network and focuses on:

- Development, recruitment and retention of AI experts
- Practical application of research results and construction of an internationally attractive AI ecosystem
- Strengthening of conditions for innovative and human-centric AI utilization in Germany and Europe.

(6) The United States

(i) "Four Principles of Explainable Artificial Intelligence

The National Institute of Standards and Technology (NIST) published a draft of "Four Principles of Explainable Artificial Intelligence" on August 18, 2020[34] and invited feedbacks until October 15 of the same year. NIST is moving forward with studies including a workshop held on January 26, 2021 based on the feedbacks.

Four principles of the draft are as follows:

- Explanation:
  AI systems need to supply evidence, support, or reasoning for each output.
- Meaningful:
  Systems need to provide explanation usable for each user.
- Explanation Accuracy:
  An explanation that correctly reflects a system's process for generating its output
- Knowledge Limits:
  Systems identify cases they were not designed or approved to operate, or for which their answers are not reliable

As part of efforts for the development of risk management framework for reliable and responsible AI, NIST released the "Proposal for Identifying and Managing Bias in Artificial Intelligence (SP 1270)" on

Available on the website below:
<https://www.din.de/en/innovation-and-research/artificial-intelligence/ai-roadmap>

[33] "Strategie Künstliche Intelligenz der Bundesregierung"
Updated Artificial Intelligence Strategy (in German) is Available on the website below:
<https://www.bmwi.de/Redaktion/DE/Publikationen/Technologie/strategie-kuenstliche-intelligenz-fortschreibung-2020.html>

[34] "Four Principles of Explainable Artificial Intelligence"
Available on the website below:
<https://www.nist.gov/publications/four-principles-explainable-artificial-intelligence-draft>

June 21, 2021[35] and invited feedbacks until August 5 of the same year.

This proposal presents an approach for identifying and managing AI bias, which is tied to three stages of the AI lifecycle, 1) pre-design, 2) design and development, and 3) deployment (and post-deployment factors).

(ii) Guidance for Regulation of Artificial Intelligence Applications

The Office of Management and Budget (OMB) issued the "Guidance for Regulation of Artificial Intelligence Applications" on November 17, 2020.[36]

The guidance consists of the three pillars below. In order to ensure consistency with the guidance, implementing agencies are required to review their authorities relevant to AI applications and submit plans regarding the outline of the relevant regulations and related information to OMB by May 17, 2021.

- Ten Principles for the Stewardship of AI Applications
- Four on-Regulatory Approaches to AI
- Reducing Barriers to the Deployment and Use of AI

(iii) Warning against possible violation of the Federal Trade Commission Act, etc.

On April 19, 2021, the Federal Trade Commission (FTC) has updated its blog and warned against using biased AI, saying that use of such AI could violate the Federal Trade Commission Act, the Fair Credit Reporting Act, and the Equal Opportunity for Financial Assistance Act.[37]

The FTC pointed out that AI could reflect problematic racial and gender biases, and that the FTC may intervene if biased tools are used in areas such as housing and employment, or if these are advertised as unbiased or trained on data collected in a misleading manner.

(iv) Establishment of AI.gov

Science and Technology Policy Bureau set up AI. gov, which is the website unifying all AI initiatives by the government on May 5, 2021.

The website is part of the government's efforts to improve transparency of the activities related to cognitive technologies by individual government offices in order to promote development of AI trusted by people. The site posts the latest reports and news, details of the six strategic pillars of AI initiatives, an archive of related laws and executive orders, and organization of AI-related committees, working groups and task forces.

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[35] "Proposal for Identifying and Managing Bias in Artificial Intelligence (SP 1270)"
Available on the website below:
<https://www.nist.gov/artificial-intelligence/proposal-identifying-and-managing-bias-artificial-intelligence-sp-1270>

[36] "Guidance for Regulation of Artificial Intelligence Applications"
Available on the website below:
<https://www.whitehouse.gov/wp-content/uploads/2020/11/M-21-06.pdf>

[37] "Aiming for truth, fairness, and equity in your company's use of AI"
Available on the website below:
<https://www.ftc.gov/news-events/blogs/business-blog/2021/04/aiming-truth-fairness-equity-your-companys-use-ai>

(7) China

The National Information Security Standardization Technical Committee published the "Guidelines for Ethical Security Risk Prevention of Artificial Intelligence" on November 9, 2020 and invited feedbacks until November 23 of the same year. Following the invitation, the guidelines were issued on January 5, 2021. [38]

The guidelines identify loss of control, social risk, infringement of rights, discriminative risk and liability risk as five ethical, moral and security risks of AI. In order to address these risks, the guidelines make the following points for AI R&D, design/production and application deployment:

- Don't conduct research for development of an AI technology aimed at damaging a basic human right
- Don't design or produce AI system, product or service that damages the public interests or personal rights.
- Clear legal basis is necessary for using AI as direct basis of decision making that influences personal rights. For important decision making in the fields of public service, financial, health, welfare and educational fields, non-explicable AI may be used only to assist decision making and not as direct basis of decision making.

(8) Institute of Electrical and Electronics Engineers

Under the global initiatives regarding Ethics of Autonomous and Intelligent Systems (A/IS) of IEEE, the AI Business Committee consisting of persons responsible for AI use and digital transformation in leading U.S. companies published a report titled the "White Paper - A Call to Action for Businesses Using AI - Ethically Aligned Design for Business"[39] on April 6, 2020 based on the "Ethically Aligned Design (EAD) First Edition"[40] published in March 2019.

The report describes the need and value of using AI ethics in companies, insights regarding human resources and skills for their sustainability and recommendations for creation of a sustainable culture of AI ethics. It proposes an AI ethics preparation framework as a guideline to determine whether a company is ready for commercialization by establishing AI ethics.

On April 6, 2021, the committee released as a more practical guide a report that compiles methods for financial service engineers to apply data to an artificial intelligence system.[41]

(9) Partnership on AI

The Partnership on AI released a report titled "The Ethics of AI and Emotional Intelligence"[42] on July

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[38] "网络安全标准实践指南—人工智能伦理安全风险防范指引"
The guidelines (in Chinese) are available on the website below:
<https://www.tc260.org.cn/front/postDetail.html?id=20210105115207>

[39] "White Paper - A Call to Action for Businesses Using AI - Ethically Aligned Design for Business"
Available on the website below:
<https://ieeexplore.ieee.org/document/9398622>

[40] The IEEE Global Initiative on Ethics of Autonomous ad Intelligent System, "Ethically Aligned Design, First Edition: A Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems" (2019)
Available on the website below:
<https://ethicsinaction.ieee.org>
For its outline, see "Report 2019" Chapter 1, 2. (1).

[41] "White Paper - Trusted Data and Artificial Intelligence Systems (AIS) for Financial Services - IEEE Finance Playbook Version 1.0"
Available on the website below:
<https://ieeexplore.ieee.org/document/9398616>

[42] "The Ethics of AI and Emotional Intelligence"

30, 2020.

Based on dialogues on AI targeting emotions, etc. and ethical issues arising from this with various sectors including industry, academia, governments and civil society, the report discusses the definition and classification of affective computing, types of human emotions, sensors and data used for affective computing.

3. Trends in international discussions

(1) OECD

AI session of the Committee on Digital Economy Policy (CDEP) was held on November 24, 2020. Report was made on the activity status of each working group ((i) AI classification; (ii) Trustworthy implementation of AI, and; (iii) Practical guidance for recommendations to the government about implementation) established under ONE AI (OECD Network of Experts on AI) [43] based on the report of each working group.

After explaining the "2020 Report," Japan shared the URL of the report's overview (English version). At a later date, comments on the reports of each working group were submitted by members of the Promotion Council and the AI Governance Review Committee, as well as by the government.

On April 15, 2021, an AI session of CDEP was held and there were presentations on the activities of each working group and exchange of opinions relating to it.

Japan provided information on the international symposium "Global Forum on AI Network Society Towards an AI-Ready Society" held in March of the same year and presented its stance on continuing to promote "safe, secure, and trustworthy implementation of AI in Society".

(2) Global Partnership on AI (GPAI)

Its first plenary meeting was held on December 3 and 4, 2020. Each of the working groups ((i) Responsible AI, (ii) AI and response to the pandemic, (iii) Data governance, (iv) Work future, and (v) Innovation and commercialization)[44] reported the review status, and a closed steering committee[45] and a ministerial council meeting were held.

The report[46] published by the "(i) Responsible AI" working group that is considered to be most closely related to the discussions of the Promotion Council summarizes the various efforts by industry, academia, the private sector, and the government to promote R&D and utilization of AI; divides the efforts into the three categories of "AI and ethics," "AI and governance," and "AI and social good"; and created a catalog.

One of the 30 promising examples of initiatives that have gone through the evaluation process is the publication of "The Draft AI R&D GUIDELINES for International Discussions" compiled by this Promotion Council

Under this working group, five internal committees mainly linked to SDGs (Drug Discovery & Open

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Available on the website below:
<https://www.partnershiponai.org/the-ethics-of-ai-and-emotional-intelligence>

[43] President Sudo and Council Member Sugiyama participate from the Promotion Council.

[44] From the Promotion Council and the AI Governance Review Committee, President Sudo and Council Member Jitsuzumi participate in (i) Responsible AI, and Committee Member Ema participates in (iv) Work future.

[45] Canada, France, Japan the United States and Italy participate in the committee as government.

[46] "AREAS FOR FUTURE ACTION IN THE RESPONSIBLE AI ECOSYSTEM"
Available on the website below:
<https://gpai.ai/projects/responsible-ai>

Science, Governance and Transparency of social media, Climate Change, Education and Issues about and Means of Governance committees) were set up and are conducting studies.

(3) G7 Summit

The communique of the G7 summit held in Cornwall, UK, from June 11 to June 13, 2021 includes the following statement: rally all partners around our open and human centric approach to artificial intelligence looking forward to the GPAI Summit in Paris in November 2021.

(4) Council of Europe Ad hoc Committee on Artificial Intelligence (CAHAI)

CAHAI held its second plenary meeting in July 2020 and its third in December of the same year[47]. At the meetings the council discussed advantages and disadvantages of forming a legal framework to regulate AI, mapped nonbinding frameworks regarding AI regulation by individual countries and major international organizations and updated the latest initiatives. In addition, CAHAI adopted a feasibility study of a potential legal framework regarding AI.

For the future, CAHAI plans to draft a legal framework and report to the Committee of Ministers of the Council of Europe.

(5) UNESCO

The Ad Hoc Expert Group on ethics of AI[48] was set up in March 2020 and started study for drafting recommendations on ethics of artificial intelligence. Following the first meeting in April of the same year, the expert group held the second meeting from August to September of the same year and produced the first draft text of a recommendation.

Individual countries submitted comments to the draft in 2020. A special intergovernmental committee was held and a draft recommendation was compiled in April and June of 2021 respectively.

The group plans to discuss and vote on the recommendation on ethics of AI at the 41st plenary meeting scheduled in November of the same year.

(6) World Health Organization (WHO)

WHO published the "WHO Guidance on Ethics & Governance of Artificial Intelligence for Health"[49] as a guide for design of AI in the medical and healthcare fields on June 28, 2021.

The guidance is the result of the discussions at the Expert Group on Ethics and Governance of AI for Health[50] that was set up in September 2019. It holds up six principles for application of AI for the public welfare of all countries: Protect autonomy; Promote human well-being, human safety and the public interest; Ensure transparency, explainability and intelligibility; Foster responsibility and accountability; Ensure inclusiveness and equity, and; Promote artificial intelligence that is responsive and sustainable.

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[47] With the initiative of France that held the presidency, establishment of CAHAI was adopted at the Meeting of Minister's Deputies held in September 2019. This is a council for which the main purpose is to establish a legal framework for examination of whether human rights and democracy are sufficiently secured in development and use of AI. Japan takes part in the initiative as an observer.

[48] Chairperson Sudo participates in the initiative from the Promotion Council.

[49] "Ethics and governance of artificial intelligence for health　WHO guidance"
Available on the website below:
<https://www.who.int/publications/i/item/9789240029200>

[50] Committee Member Ema takes part in the group from the AI Governance Review Committee.

(7) UN World Forum for Harmonization of Vehicle Regulations (WP.29)

The first international standards pertaining to automated driving systems (Level 3) were established at WP.29 on June 24, 2020.

Key requirements of the international standards for automated driving systems include:

- Accident avoidance performance that is equal to or safer than the performance of a careful and competent human driver
- Mounting of a driver monitoring system
- Mounting of a device to record the operating state of the system[51].

(8) Trends of international standardization

(i) IEEE

In the process of considering Ethically Aligned Design (EAD), IEEE has been working for standardization[52]. Currently there are 14 standardization projects from P7000 to P7014 (P7013 is missing).[53]

- P7000: Model Process for Addressing Ethical Concerns During System Design
- P7001: Transparency of Autonomous Systems
- P7002: Data Privacy Process
- P7003: Algorithmic Bias Considerations
- P7004: Child and Student Data Governance
- P7005: Transparent Employer Data Governance
- P7006: Personal Data Artificial Intelligence (AI) Agent
- P7007: Ontological Standard
- P7008: Ethically Driven Nudging for Robotic, Intelligent and Autonomous Systems
- P7009: Fail-Safe Design of Autonomous and Semi-Autonomous Systems
- P7010: Well-being Metric for Autonomous and Intelligent Systems
- P7011: Process of Identifying and Rating the Trustworthiness of News Sources
- P7012: Machine Readable Personal Privacy Terms
- P7014: Emulated Empathy

In addition, a project for Organizational Governance of Artificial Intelligence (P2863) was adopted in February 2020 and a project for eXplainable Artificial Intelligence (P2976) was adopted in February 2021.

(ii) International Organization for Standardization (ISO)/ International Electrotechnical Commission (IEC)

ISO/IEC issued ISO/IEC TR 24084 that overviews trustworthiness of artificial intelligence in May 2020. The document includes approaches to establish trust in AI systems through transparency, explainability, controllability, etc. and approaches to assess and achieve availability, resiliency, reliability, accuracy, safety, security and privacy of AI systems, for example.

ISO/IEC also issued ISO/IEC TR 24030 that is a collection of representative use cases of AI applications. The document provides 132 use cases gathered by experts for the period from July 2018 to November 2019.

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[51] Antecedent to the establishment of the international standards, automated driving system standards of equivalent content were enforced in Japan on April 1, 2020.

[52] For the past IEEE trends (including standardization) see Chapter 1, 2 (1) of the Report 2018 and Chapter 1, 2 (1) of the Report 2019. Efforts related to EAD were described above (see 2 (8) of this chapter)

[53] Japanese translation of the standardization projects follows “Standardization of Ethics and Trust of Artificial Intelligence” by EGAWA Takashi, Journal of the Institute of Electronics, Information and Communication Engineers, Vol.104 No.1 pp.60-63.

Other projects include studies on the "ISO/IEC 22989 draft" to define artificial intelligence concepts and terminology and the "ISO/ICE TR 24027 Draft" regarding Bias in AI systems and AI aided decision making.

(9) Bilateral policy dialogues and memorandum of cooperation

(i) Japan-U.S. Policy Cooperation Dialogue on the Internet Economy

The Japan-U.S. Policy Cooperation Dialogue on the Internet Economy was held on September 17 and 18 of 2020 and public-private discussions were held to support responsible governance of trustworthy AI at its AI session. MIC shared the points of the overview of "Report 2020" (English version) on this occasion.

Both countries reconfirmed their support for the OECD recommendations on AI and confirmed continuing collaboration on AI through OECD and GPAI.

(ii) EU-Japan ICT Strategies Workshop

The EU-Japan ICT Strategies Workshop was held on October 1 and 2 of 2020 and opinions on policy trends on each side and challenges in business were exchanged at its AI session. MIC explained the overview of "Report 2020" on this occasion.

Both Japan and EU pointed out that it is necessary to precisely define AI and high-risk AI that were presented in the White Paper on AI published by EU[54] in February 2020 and called for continued discussions by various stakeholders.

The workshop was held on April 15 and 16 of 2021 and the EU introduced a draft AI regulation framework at its AI session. Both Japan and EU confirmed the common recognition that the goal of AI governance was trust and human-centered AI and that they would continuously exchange opinions.

(iii) Japan-Germany ICT Policy Dialogue

The Japan-Germany ICT Policy Dialogue was held on March 11, 2021 and MIC explained the overview of "Report 2020" at its AI session.

(iv) Japan-France ICT Policy Consultation

The Japan-France ICT Policy Consultation was held on June 17, 2021 and MIC explained the overview of "Report 2020" at its AI session.

(v) Signing a Memorandum on Cooperation with India

On January 15, 2021, Japan (MIC) and India (Ministry of Communications) signed a memorandum on comprehensive cooperation in the field of information and communication technologies. Regarding AI, the two countries will promote and strengthen cooperation for the following:

- Promotion of information sharing on AI initiatives in the information communication fields of both countries
- Human resource development for AI standardization
- Establishment of a Center of Excellence for AI for communications

(vi) Signing a Memorandum on Cooperation with Singapore

[54] See Note 18 above

On July 2, 2021, Japan (MIC) and Singapore (Ministry of Communications and Information) signed a memorandum on comprehensive cooperation in the field of information and communication technologies. Regarding AI, the two countries will promote and strengthen cooperation for the following:

- Exchange of opinions on best practices and policies related to adoption of AI in industry, governance and ethics,
- cooperation and harmonization, joint training and program regarding AI implementation, governance and ethics
- Mutual recognition of the importance of building a framework for use of AI and international harmonization
- Discussions on an AI governance framework consistent with international principles and guidelines

4. International Symposium “Global Forum on AI Network Society Towards an AI-Ready Society”

On March 1, 2021 MIC hosted the International Symposium "Global Forum on AI Network Society Towards an AI-Ready Society" with the aim of contributing to the resolution of social issues through discussions on the arrival of the future AI society and data economy, and discussions on the possibility of utilizing AI to counter the problems caused by COVID-19, which is spreading worldwide. In addition to the members of the Promotion Council and the AI Governance Review Committee, together with representatives of the OECD, experts and business leaders from a wide range of fields in Japan and countries from around the world participated and exchanged opinions.

Participants of the forum presented opinions on the macroeconomic potential of AI and data, the direction of efforts to promote its utilization, and the importance of the study of ethics and social sciences for AI developers. Given the impact of COVID-19, discussions were held on topics such as the need to change the current mindset, develop human resources, and promote educational reforms for the transition to the “post-corona” era in order to realize effective utilization of technology, and the need to work on governance structures that emphasize AI ethics for AI implementation in society. The content of the forum is summarized in Attachment 1.[55]

Regarding AI ethics and governance, in particular, there were the following opinions and discussions:

- Innovative technologies including AI, IoT, Big Data, 5G, and Quantum computers have been developed and implemented, leading to a revolutionary paradigm shift in the world's social and industrial structures. In order to prevent a society where humans are controlled by AI, Japan has studied AI ethics and contributed to international discussions. It is important to further study AI ethics for the sound development of Japanese society
- Some AI algorithms are suspected of being biased according to gender and/or race. When AI learns from biased data, it is necessary to correct the bias and use fair data.
- It is said the STEM (science, technology, engineering and mathematics) is important for AI, but it is also important to consider ELSI (ethical, legal and social issues) from the perspective of the impact of AI on society. Socially acceptable AI needs both STEM and ELSI and it is important for AI developers to learn ethics and social sciences.
- International standards on AI ethics and governance have been based on soft law (non-binding relaxed rules), but there are proposals in Europe to regulate AI by statutory laws rather than soft law. When AI is

[55] English version is available on the website below:
<https://www.soumu.go.jp/main_content/000745776.pdf>

implemented, it will be necessary to reconsider the civil liability regime.

- One reason that we need AI Principles is that we need consumers to trust products/services using AI. Another reason is the risk of undermining human rights, freedom and autonomy. In particular, we need to regard the latter as corporate ESG (environment, society and governance) and address it as a corporate governance issue. It is important to view this as an issue of supply chains and contractual governance beyond single company or group.
- Japan leads other countries in the ethical guidelines of AI. GPAI (Global Partnership on AI), a public-private international collaborative organization, intends to share best practices to advance discussions. For future discussions on the impact of AI, it is important to separate quantifiable economic issues from anxiety and concerns that are difficult to quantify.
- Actual AI business can violate many existing laws. Because many legal problems have occurred concerning existing laws, it is important to study possible countermeasures. There is a graphic example in smart city initiatives, where businesses that have been developed with considerable effort had to be stopped. In order to continue AI business, it is important to study measures from the legal, ethical and social receptivity points of view from the conceptual stage of AI business.
- Various systems and services using AI are spreading but development methodology for systems incorporating AI is not yet established. Applying AI to real-world projects would require continuous review of AI models in addition to defining AI development methodology. Because these initiatives are difficult for a single company to tackle, it is important to cooperate with various companies.
- Problems regarding AI ethics should be divided into quality and safety issues, fairness and human right issues, for example. Because issues concerning AI cannot be solved by a single company, it is important to share priorities among stakeholders including AI component procurers and AI module customers.
- Recently, enterprises consider cybersecurity as one of their business challenges and it is becoming common to spend on cybersecurity. Similarly, AI ethics will become an important factor in the future and it will become common to spend on this issue.
- I think efforts regarding AI ethics are essential for enterprises that use AI technologies to provide products/services. It is important to earn consumers' trust through AI assessment in future corporate activities. These efforts will also increase the brand strength of the company.
- In the future, not only AI developing companies but also companies using AI will be held responsible in many cases. While observing the trends of AI legislation and formulation of rules on AI ethics, it is important to improve internal governance, literacy and human resource development in order to respond to the trends.
- Companies need to change their behavior regarding AI governance. Insurance may be used as a tool to urge behavioral change by providing insurance to companies properly tackling AI ethics and governance, while not providing insurance to other companies.
- The relationship with SDGs (Sustainable Development Goals advocated by UN) is also emphasized in GPAI. Various projects will be advanced in connection with SDGs, but it is difficult for AI specialists to solve the issues alone due to limited information. It is expected that mutual disclosure by information holders will advance discussions on ideal AI society and produce good solutions.
- We need forums to study best and good practices through free discussions among all stakeholders. It is important to have continuous multiple stakeholder discussions. It is also important to increase the level of the entire industry and human resource development by taking advantage of the knowledge of advanced companies. Collaboration between the public and private sectors and diversity are also key.

For the future, it is important to promote implementation of AI in society based on these opinions and discussions.

Chapter 2 COVID-19 and Utilization of AI

Various initiatives are executed to address the spread of COVID-19. Some of the initiatives use AI to develop therapeutic medications and vaccines or to avoid conditions of overcrowding. For example, at a joint meeting of the Promotion Council and the AI Governance Review Committee (November 12, 2020) opinions were exchanged and discussions were deepened based on a presentation regarding an initiative to develop COVID-19 therapy using AI and supercomputer Fugaku.[56] In the shift to a new lifestyle called "the New Normal", AI is considered to play a big role.

This chapter takes a view of AI utilization following the spread of COVID-19 and attempts an international comparison of AI utilization to counter COVID-19.[57]

1. Prospects for AI Utilization following the Spread of COVID-19

(1) Framework of the prospects

COVID-19 spread not only in Japan but all over the world and had a big impact on society and economy. In considering the prospects for AI utilization, we divided the situation into three stages: "outbreak of COVID-19," "spread of infection," and "post-corona (shift to a new normal)". Then, after considering the impacts on society and the economy in each stage, we put together case studies assuming the AI utilization corresponding to them as shown in the table below.

- Outbreak of COVID-19

  New infection cases and increase in severity of patients have become a problem calling for early development and provision of therapeutic medications and vaccines.

- Spread of infection

  Clusters and tight conditions in medical institutions have become a problem, which calls for prevention of mass infection by avoiding conditions of overcrowding and close contacts while improving the condition for medical institutions. Changes in daily life have already started in various scenes, which include curbing of commuting, school attendance, travel and events.

- Post-Corona (shift to a new normal)

  Daily life changed at the stage of the spread of COVID-19 and is not expected to completely return to the lifestyle before the stage. Specifically, the rate of telework increased in workplaces, education, online remote lectures and classrooms were introduced and use of cashless settlement and electronic commerce increased in daily shopping and business transactions. It is believed that digitalization and digital transformation will further advance in the future. Furthermore, these changes in people's lifestyle and society will continue to influence corporate performance and employment.

  In addition, Japan's digitalization and digital transformation are expected to promote effective utilization of resources and thereby contribute to sustainability of the global environment.

[56] Presentation by Professor OKUNO Yasushi (Department of Biomedical Data Intelligence, Graduate School of Medicine, Kyoto University). For the details, see 4. of the next chapter and Attachment 3.

[57] For AI utilization to counter COVID-19 before publication of the "Report 2020," see Chapter 1, 1 of the "Report 2020."

[Stage] (Impact on society and the economy)	Use case
[Outbreak of COVID-19]	
Infections and advancing in severity	(i) Improving efficiency and sophistication of therapeutic medication and vaccine development
[Spread of infection]	
Spread of infections (n-order infection) Lack of medical supplies	(ii) Avoidance of overcrowded conditions and close contact. Optimal supply of medical materials
Tight conditions for medical institutions	(iii) Improving efficiency and sophistication of the medical care and treatment process
[Post-Corona (shift to a new normal)]	
Cutting commuting and school attendance	(iv) Supporting employees in remote work (v) Sophistication of education under remote conditions
Curbing store visits, face-to-face customer service, and services	(vi) Labor-saving and unstaffed store operations (vii) Bringing services online and improving efficiency of logistics
Cutting entertainment (travel and events)	(viii) Creating online entertainment
Changes in business activities and employment conditions	(ix) Digitalization of commerce (x) Sophistication of training and employment matching for job seekers

The Promotion Council holds out the principle "realize human-centered society" where benefits of AI utilization are enjoyed by everyone. From this "inclusiveness" perspective, it is important to ensure reasonable accommodation[58] in order to leave no one behind in AI utilization to counter COVID-19 as well as in the digitalization and digital transformation upon which the former is premised.

(2) Prospects of AI utilization

In the use cases assumed in (1) above, we surveyed AI utilization following the spread of COVID-19. In the prospects, utilization is divided into the two stages of "already put to practical use" and "likely to be realized in the near future or in the medium term". Because quick response is required to counter COVID-19, relatively more use cases of "already put to practical use" category are taken up in order to promote implementation in society. We also need to pay attention to the point that AI utilization is not limited to the assumed use cases.

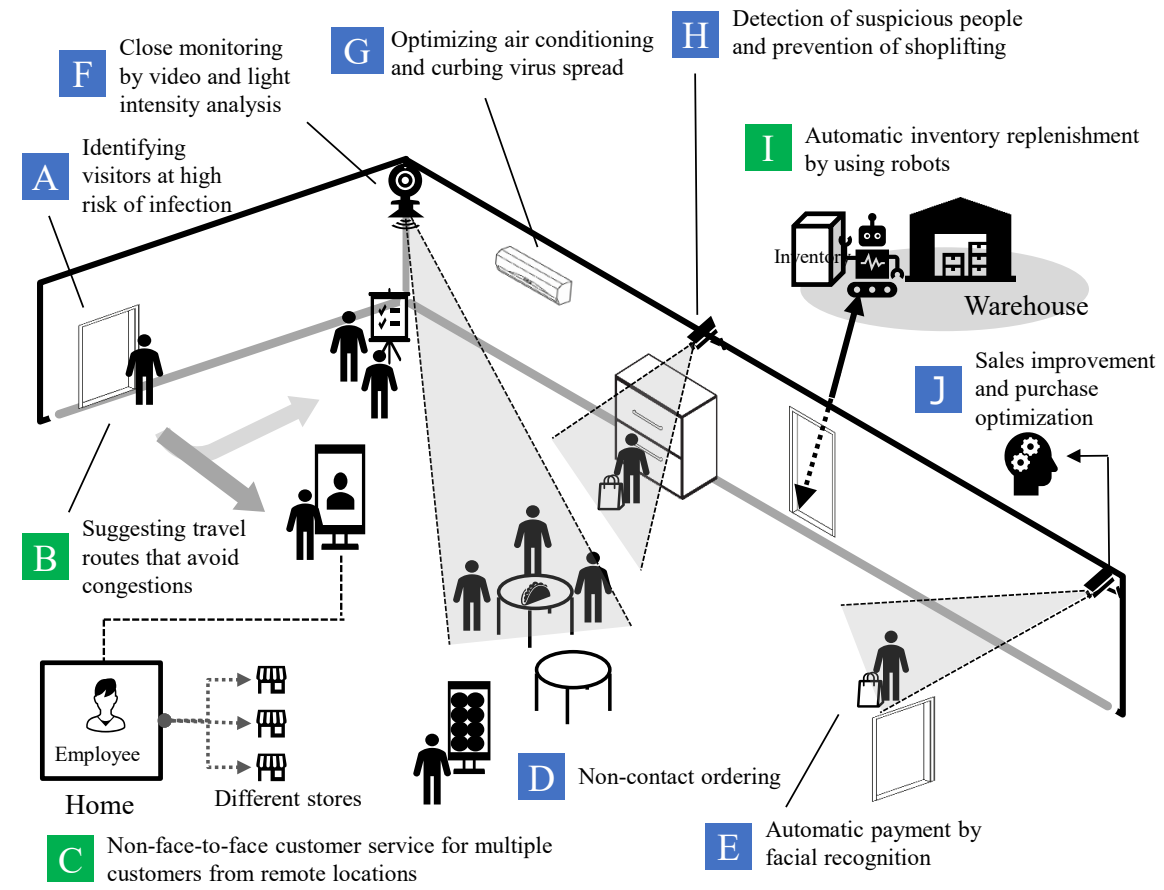
We surveyed AI utilization of these use cases as shown in the example of (vi) "Labor-saving and unstaffed store operations" below. Prospects of AI utilization of individual use cases are shown in Attachment 2-1.

AI utilization listed in the use cases do not always assume the current legal systems of specific

[58] For example, Article 2 of the Convention on the Rights of Persons with Disabilities (promulgated on January 20, 2014) provides the following definition; "Reasonable accommodation" means necessary and appropriate modification and adjustments not imposing a disproportionate or undue burden, where needed in a particular case, to ensure to persons with disabilities the enjoyment or exercise on an equal basis with others of all human rights and fundamental freedoms.

countries/regions, but views possible use in the future. For this reason, some of them are difficult to realize under the current legal system and will be used to identify system challenges for the utilizations in the future. The use cases also include utilizations that may be difficult with the currently available technologies or technologies under research, but may become possible in the future. AI utilizations that have been made or assumed before the spread of COVID-19 are also included when these are thought to be effective or helpful as COVID-19 countermeasures. In addition, we need to pay attention that economic costs will be considered when putting them to practical use.

Labor-saving and unstaffed store operations



A Identifying visitors at high risk of infection
- Analyzing camera images to determine body surface temperature and whether the person is wearing a mask

B Suggesting travel routes that avoid congestions
- Using camera images to identify congestions and suggesting travel routes with low risk of infection

C Non-face-to-face customer service for multiple customers from remote locations
- Customer service through digital signage in multiple stores simultaneously

D Non-contact ordering
- Measuring the distance between the device and the person's finger and allowing contactless ordering without touching the screen

E Automatic payment by facial recognition
- Identifying the person who is leaving the store by camera image and automatically settling the payment of the service purchased or used

F Close monitoring by video and light intensity analysis
- Using camera images to grasp differences between overcrowded and comfortable work environments and notifying employees

G Optimizing air conditioning and curbing virus spread
- When it is discovered that a visitor is infected, the air is automatically replaced to prevent the virus from spreading within the store

H Detection of suspicious people and prevention of shoplifting
- Using camera images to predict people's behavior, detect suspicious people, and prevent shoplifting

I Automatic inventory replenishment by using robots
- Grasping inventory status and having robots automatically replenish the inventory

J Sales improvement and purchase optimization
- Analyzing customer information, sales results, etc., and proposing measures to improve sales and optimize purchasing

Already put into practice
Likely to be realized in the near future, and in the medium to long-term

AI utilizations surveyed here are expected to be effective or beneficial as COVID-19 countermeasures or to contribute to social activities in the "post-corona" era. However, considering that some people cannot or do not choose to use AI, and that Japan holds up "human-friendly digitalization that leaves no one behind" as the vision of the digital society it aims at,[59] it is necessary to ensure reasonable accommodation so that services are provided in a way to include all people in society. If social changes cause change in the behavior of these people, new AI utilization needs may arise. It is a future task to survey future AI utilization in a society where digitalization will progress more widely and comprehensively.

(3) Case Studies

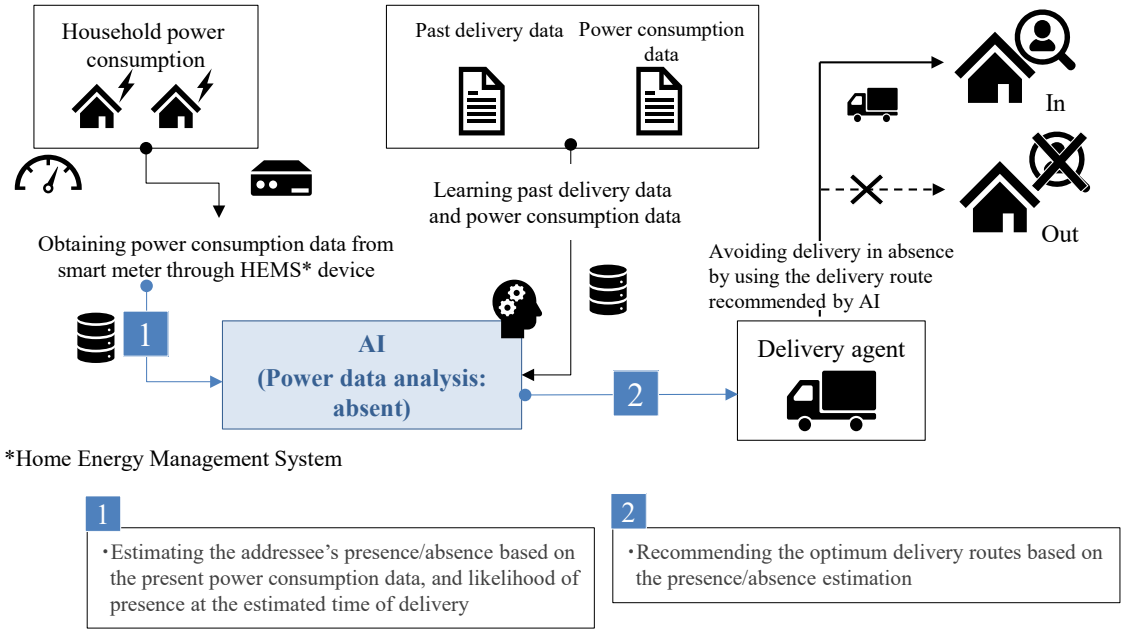
Based on the prospects of AI utilization in (2) above, we conducted case studies on three cases (curving spread of infection; improving efficiency and sophistication of medical care and treatment process, and improving efficiency of logistics/delivery,) and summarized specific benefits and challenges toward future implementation in society.

In selecting subjects of the case studies, expecting wide diffusion in society, we considered scope and attributes of users (whether or not a large number of general users are covered), whether or not there is collaboration of multiple business operators/organizations, level of the impact of possible information leak or abuse and other factors. COVID-19 countermeasure has become a pressing issue for countries/regions all over the world, but this report primarily summarizes benefits and challenges with implementation in Japanese society mind (but it also includes those common across countries/regions).

For example, outline of "improving efficiency of logistics/delivery" is as follows:

Background		Response by AI utilization
Since before COVID-19, inefficiency of delivery service has been a challenge due to absences of the addressees and redeliveries, in addition to a shortage of delivery drivers. Furthermore, there is a call for efficiency improvement of delivery service because the number of deliveries increased with the increase in use of e-commerce caused by the spread of COVID-19.	⇒	Presence/absence is predicted based on the analysis of the past delivery data and the power consumption data obtained from home smart meters. Based on the analysis, optimum delivery route is presented to deliverers to solve the issue of delivery in absence of the addressee and thereby improve efficiency and productivity of the service.

[59] See "Basic Policy for Reforms towards the Realization of Digital Society" (Cabinet Decision on December 25, 2020)



The following benefits are expected in this case:

- ➢ Delivery services can improve operational efficiency and productivity through reduction of deliveries in absence and redeliveries, as well as efficient delivery.
- ➢ Addressees are freed from the procedures including requesting redelivery and specifying delivery times and can also eliminate waiting time.
- ➢ Socially, reduction in deliveries in absence and redeliveries and efficient delivery are expected to contribute to reduction in CO2 emissions.

While these benefits are expected, the following challenges are prospected toward implementation in society:

- ➢ It is desirable to improve the rules regarding protection of personal information, which vary among local governments, in order to standardize systems and operation to improve productivity of deliveries across jurisdictions of multiple governments.
- ➢ It is necessary to carry out thorough information management in order to prevent leak of presence/absence information, which could lead to privacy infringement and crime.
- ➢ It is necessary to enhance reliability in order to wipe away concerns about abuse of electricity data of households so that the services will be accepted in society.

There are the problems of long working hours and heavy quotas of logistics/delivery operations. We need to pay attention to improvement of the working environment and protection of employees for promotion of implementation in society.

As in the case of "improving efficiency of logistics/delivery," we also summarized benefits and challenges of implementation in society in case studies of "curving spread of infection" and "improving efficiency and sophistication of medical care and treatment process." Details of the case studies are shown in Attachment 2-1.

Similarly with AI utilization surveyed in (2) above, AI utilizations assumed in the case studies do not always assume the current legal system of specific countries/regions, but views possible utilization in the

future and also include utilizations difficult under the current legal systems.

Some of the challenges found in the case studies are common in many fields and it is desirable to tackle them toward implementation of AI in society. In this respect, awareness of problems toward future initiatives can be summarized as follows:

- ➢ It is important to raise social acceptance of AI while improving service quality and convenience including improvement of the precision of AI
- ➢ It is important to adjust the balance between service quality/convenience and privacy protection.
- ➢ It is important to promote multifaceted studies including technology development to enhance service quality/convenience, while at the same time maintaining the high level of privacy protection.
- ➢ Risk management systems and employee education by business operators are important for prevention of information leak and abuse.
- ➢ Data standardization is important for different business operators to collaborate to provide high-quality services.
- ➢ Rules regarding personal information protection vary among local governments, which interferes with improvement of operational efficiency and productivity. We need unification of the rules regarding personal information protection

There are various opinions on the balance between service quality/convenience and privacy protection.[60] When providing utility service, it is important to consider appropriate handling based on the provision of the Act on the Protection of Personal Information (Act No.57 of 2003) in items of Article 23 paragraph (1) that do not require the consent of the person when providing personal data to a third party in certain patterns including those where it is necessary for improving public health.

The issue above including this point is not limited to COVID-19 countermeasures. For general utilization of AI in society, it is also important to promote utilization with this in mind.

For example, individual business operators are working on improvement of service quality/convenience, risk management systems and employee education as described in the next chapter.[61] For unification of the rules regarding personal information protection, the Act on the Arrangement of Related Laws for the Formation of a Digital Society (Act No. 37 of 2021) that was enacted on May 12, 2021 amended the Act on the Protection of Personal Information. It stipulates promotion of common nationwide rules for local governments' personal information protection systems and unification of the entire jurisdiction under the Personal Information Protection Commission.

2. International comparison of AI utilization in response to COVID-19

As COVID-19 continues to spread all over the world, each country/region is taking measures using AI to

[60] For example, the World Economic Forum has made recommendations, which include calls for: a new data governance model that aims to strike a balance between individual rights and the interests of data holders and the public interest. See "APPA –Authorized Public Purpose Access: Building Trust into Data Flows for Well-being and Innovation" and "Resetting Data Governance: Authorized Public Purpose Access and Society Criteria for Implementation of APPA Principles WHITEPAPER APRIL 2021.
Available on the websites below respectively:
<https://www.weforum.org/whitepapers/appa-authorized-public-purpose-access-building-trust-into-data-flows-for-well-being-and-innovation>
<https://www.weforum.org/whitepapers/resetting-data-governance-authorized-public-purpose-access-and-society-criteria-for-implementation-of-appa-principles>

[61] See 2.(1) and (3) and 4. of the next chapter and Attachment 3.

counter COVID-19. Here we attempt international comparison of AI utilization to counter COVID-19.

(1) Selection of target countries/regions for international comparison

We chose Japan, the United States, the United Kingdom, France, Germany, Estonia, Finland, China, South Kore, Singapore, Israel and Taiwan for our international comparison and mostly surveyed the efforts of their central and local governments to counter COVID-19 by using AI. (For selection of the target countries/regions, see below.)

When selecting target countries/regions, we considered the points of view including: (i) effective utilization of AI to counter COVID-19 may be difficult without a certain technological level, and; (ii) consideration of the level of the impact of COVID-19 may be important for comparison of the effect of AI utilization to counter COVID-19 (whether or not utilization of AI could effectively suppress the spread of infection[62]). Specifically, we focused on the following criteria for selection:

(i) Ranked within the top 20 in the AI Readiness Index (assessing AI R&D, visions for implementation in society, digital skills, etc.) published by Oxford University

(ii) Number of deaths caused by COVID-19 per population of 100,000 is high (5 people or more) or low (2 people or fewer) based on the values published by the European Centre for Disease Prevention and Control.

(In all cases, we used the values as of November 2020 when we started the survey. For conditions of the countries/regions regarding the criteria, see Attachment 2-2.) Taiwan does not fulfill the criteria (i), but we included the country considering that it may be ranked low due to missing values in the survey data, and because it took characteristic measures to prevent and suppress the spread of infection (utilization of contact confirmation and tracking apps).

(2) AI utilization to counter COVID-19

(i) Overview of AI utilization

Regarding the target countries/regions selected in (1) above, we surveyed the efforts by central and local governments in response to COVID-19 (medical care; preventing infections and suppressing the spread of infections; education; and employment and livelihood support) and found the common AI utilization cases listed below.[63]

● Medical care: Improving efficiency and sophistication of medical operations related to COVID-19
  - Forecasting the number of people infected with COVID-19
  - Vaccine development and scrutiny of adverse reaction information
  - Analysis of CT images
  - Chatbot support for consultation on COVID-19

● Preventing infections and suppressing the spread of infections: Tracking the behavior of people infected with COVID-19, and their close contact, and visualizing the risk of infection
  - Tracking citizens' behavior using contact confirmation and tracking apps
  - Visualizing overcrowded conditions in public facilities and tourist sites
  - Predicting congestion on public transportation

[62] We need to pay attention to the fact that COVID-19 countermeasures are not limited to those using AI.
[63] Based on MIC "Research study on AI utilization following the spread of COVID-19." This is not a comprehensive survey but a summary based on the study.

● Education: Improving the efficiency and sophistication of student education, which has become remote due to COVID-19

- Applying adaptive learning based on students' level of understanding
- Providing digital content for learning AI online

● Employment and livelihood support: Support for citizens who have lost income or jobs, and for companies whose performance has deteriorated, due to COVID-19

- Providing job opportunities to unemployed job seekers
- Improving the efficiency of loan procedures for companies with declining business performance
- Chatbot support for inquires related to procedures

Specific examples regarding these AI utilizations are compiled in Attachment 2-2.

(ii) AI utilization to prevent infection and suppress the spread of infection

There are many common activities regarding AI utilization to counter COVID-19 across countries and regions, but relatively large differences between countries and regions were observed with regard to the use of AI for "prevention of infection and control of the spread of infection" (contact confirmation and tracking app[64]) in the following aspects:

● Degree of government coercion

- Is the use of the app compulsory? Are people penalized for violating the regulation? As a result, what kind of personal information does the government have access to?
- What is the tolerance level of citizens regarding the collection of personal information by the government?

● Scope of collected data

- Does the data to be collected include only information on whether the user has been in close contact with others for a certain period of time, or does it also include location information, purchase data, etc.?

● Scope of AI utilization

- Is it only for contact determination (no AI utilization) or does it include AI analysis of collected data?

Based on the above, we summarized the situations of contact confirmation and tracking apps in different countries/regions as follows:

[64] Apps with these functions may not necessarily use AI systems. However, the report includes cases where AI systems are not directly used, because these are a form of utilization that analyzes and makes decisions based on gathered data and are considered to be an important model case for international comparisons.

Contact confirmation and tracking apps

Types of utilization		Purpose	Collection data	Degree of government intervention	Applicable country/region
Required (mandatory)	Required for all citizens	• Encouraging early detection, isolation, diagnosis, and treatment of infected people through thorough contact confirmation and tracking.	• Location information • Purchase information • Camera image information • Medical care	• The government gathers information and uses it for making predictions using AI.	• China
	Required for isolated people / foreign travelers	• Tracking the behavior of infected people and those in close contact, and facilitating early detection, isolation, diagnosis, and treatment of infected people.	• Location information (South Korea and Taiwan) • Purchase information (South Korea) • Camera image information (South Korea)	• The government gathers information and uses it for making predictions using AI. • In South Korea, penalties are imposed for refusing to follow hospitalization recommendations. • In Taiwan, penalties are imposed for refusing to quarantine.	• South Korea, Taiwan
Voluntary (not mandatory)	Optional (there are disadvantage)	• Preventing the spread of infection by checking and tracking the behavior of users who have installed the contact confirmation and tracking apps.	• Location information	• The government is asking people to present the app at shopping malls and other places. • In Singapore, citizens can be ordered to provide personal information for epidemiological studies.	• United Kingdom, Singapore
	Optional (no disadvantage)	• The contact confirmation and tracking app will present the risk of infection and discourage unnecessary behavior by the public.	• Anonymous code for infected people	• There is no disadvantage associated with non-use, and individuals are free to choose. • Individuals are not identified.	• Japan, United States, France, Germany, Estonia, Finland, Israel

Source: compiled based on the data published by the governments of the countries/regions[65]

In China, South Korea and Taiwan, contact confirmation and tracking apps are used with a certain legally binding force and penalty may be imposed on a violation of the rule. In addition to position information, purchase information and image information captured by camera are also collected. In Japan and Western countries, use of these apps is voluntary (without legal force), only a few types of data are collected, and their use is limited.

This way, there are differences in utilization of contact confirmation and tracking apps depending on the country/region. The differences are giving rise to differences in the adjustment of the balance between AI utilization for improvement of public health and privacy protection. In the future, similar situations may appear in AI utilization for other purposes and the adjustment is believed to become an important issue.

3. Future initiatives

COVID-19 has spread all over the world and is making a big impact on society and economy. While suppressing its spread, it is also important to promptly build and shift to a post-corona society.

(1) Promote digital transformation

As discussed in 1. and 2. above, AI will play a big role in addressing COVID-19. For further promotion of AI utilization, it is important to develop social infrastructure and social environment including digitalization and digital transformation, which are necessary for AI utilization as described 1. (1) above. There are opinions that initiatives regarding data, human resources/organization and security, consideration for privacy and review of business design based on a method that can use AI and other ICT tools are important for promotion of digital transformation.

●Data : Design what data is necessary for what purpose
: Study data collection methods and decide whether or not to disclose the collected data.

[65] See Attachment 2-2 for URL of the websites providing the information regarding the countries/regions.

: Cross-organizational distribution of highly reliable data
: Processing including cleansing for AI utilization

●Human resources/ organization
: Develop and secure human resources who understand the relationship between the business and technology/data.
: Break away from vertical division of departments and construct an organization that assumes cross-sectional digitalization and data utilization.

●Security
: Identify risks associated with digitalized services
: Measures based on zero trust security[66]

(2) Initiatives for promotion of AI utilization

As described in 2. above, AI is used to counter COVID-19 in countries/regions around the world. It is thought that some of these efforts are yet to yield results but expectations regarding AI are considered to be high.

As described in Introduction, Japan is promoting initiatives toward "Society 5.0" that promote economic development and solve social issues through the Cyber-Physical System (CPS) that integrates cyberspace and physical space. The initiatives include R&D on cybernetic avatars that expand human physical abilities, and cognitive capability and perceptive senses through sophisticated utilization of the technologies known as robotics and avatar.[67] Their realization is expected to contribute to COVID-19 countermeasures including non-contact/non-face-to-face services and to social activities and lifestyles in the "post-corona" era.

There are many common activities regarding AI utilization to counter COVID-19 across countries and regions, but relatively large differences between countries and regions were observed with regard to the measures involving personal information and privacy, which include contact confirmation and tracking apps. It is believed that the differences may be attributed to historical causes regarding infection. For example, in countries/regions that were forced to address severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) and have advanced discussions on system development in preparation for possible new infections, people may be more tolerant of invasion of privacy by governments. For Japan, it is important to take measures that can gain public understanding while considering the conditions of other countries/regions. In this regard, it is believed that Japan should actively tackle technology development for improvement of service quality and convenience, while at the same time ensuring a high level of privacy.[68] It is necessary to obtain public understanding of these efforts and it is important to increase social acceptability by improving the literacy of individual citizens. Stakeholders including the government are required to support this process.

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[66] Unlike conventional security measures that try to ensure security based on a concept of inside/outside of a firewall, this approach, assuming that all accesses to information assets are unreliable, checks each access and permits only reliable accesses.

[67] The initiative is advanced under the moonshot research and development program of the Japan Science and Technology Agency. The goal of the initiative is: Realization of a society in which human beings can be free from limitations of body, brain, space, and time by 2050. For the details, visit the website of the URL below: <https://www.jst.go.jp/moonshot/program/goal1/index.html>

[68] For example, the World Economic Forum proposes Authorized Public Purpose Access (APPA) that is a model for realizing the targeted value by permitting access to data for specific, agreed public purposes, such as the development of medical care and the improvement of public health, through processes that do not rely exclusively on explicit, individual consent as a means of protecting human rights. See note 60 above.

In order to find appropriate balance between improvement/extension of public health and privacy protection as suggested in the "Report 2020"[69], it is important for the Promotion Council to discuss the degree of priority and importance of the individual principles for emergency response in order to avoid severe damage by relaxing of some of the principles. In order to appropriately respond to the situation based on the state of international AI utilization to counter COVID-19, it is thought necessary to review the "Draft AI R&D Guidelines for International Discussions" and "AI Utilization Guidelines" compiled by the Promotion Council.

[69] See Note 117 of the "Report 2020".

Chapter 3 Initiatives to Promote "Safe, Secure, and Trustworthy Implementation of AI in Society"

In the light of the adoption of the council recommendations including AI principles by OECD in May 2019 and the adoption of G20 AI Principles in June of the same year, it is thought that initiatives of individual countries and international discussions on AI are shifting from development of guidelines and principles to implementation in society.

The Promotion Council, after compiling the "Draft AI R&D Guidelines for International Discussions" (July 2017, "AI R&D Guidelines") and the "AI Utilization Guidelines" (August 2019) conducted hearings of stakeholders[70] including AI developers, service providers, business users and consumer users in order to promote "Safe, Secure, and Trustworthy Implementation of AI in Society" and summarized their activities in the "Report 2020" (July 2020)[71]. The report suggests that it is necessary to continuously conduct hearings and organize its content as "shared knowledge"[72].

Following the release of the "Report 2020," the joint meeting of the Promotion Council and the AI Governance Review Committee was held in November 2020 and hearings ("the hearings, etc..") were conducted by the chair of the Promotion Council until April 2021. Based on the results of the activities, this Chapter introduces initiatives of business operators and summarizes points of attention toward promotion of "Safe, Secure, and Trustworthy Implementation of AI in Society" and future initiatives.

1. Overview of the hearings, etc.

After compiling the "Report 2020" the Promotion Council exchanged opinions through the hearings, etc. based on the presentations by business operators who are making advanced or ambitious efforts to implement AI in society. With the objective of the promotion of "Safe, Secure, and Trustworthy Implementation of AI in Society" in the future, key points of the hearings follow the points[73] of the hearing of the "Report 2020." Specifically, opinions were exchanged and discussion was deepened with focus on the following:

- What kind of initiatives will developers and users (AI service providers and business users) adopt to promote "safe, secure, and trustworthy implementation of AI in society" or to improve the acceptance of AI in society?
- To promote these efforts, what issues do businesses face, and what should be done to resolve them?
- What kind of environment should be created to encourage acceptance and promote "safe, secure, and trustworthy implementation of AI in society"?

As described in the previous chapter, because there are big expectations for AI utilization to counter COVID-19 and because such initiatives are advanced, opinions were exchanged and discussion was also deepened on this topic.

[70] For classification of stakeholders, see "AI Utilization Guidelines"
[71] See Chapter 3 to Chapter 7 of the "Report 2020."
[72] See "In Place of Conclusion" of the "Report 2020."
[73] See "Introduction" of the "Report 2020."

The hearings, etc. were implemented as shown in the table below:

	Presenter	Title
2020		
Joint meeting of the Conference toward AI Network Society and the AI Governance Review Committee (November 12)	Yasushi Okuno (Professor, Department of Biomedical Data Intelligence, Graduate School of Medicine, Kyoto University) [Prof. Yasushi Okuno (Kyoto University Graduate School)]	Challenge of developing COVID-19 treatments using the supercomputer "Fugaku" and AI
1st Hearing (November 25)	Fujitsu Laboratories Ltd. [Fujitsu Laboratories]	Fujitsu's AI Research Activities in the New Normal
	Google LLC [Google]	Putting our AI Principles into practice
2nd Hearing (December 25)	National Institute of Information and Communications Technology [NICT]	Large-scale natural language processing technology aimed at solving social issues
	NEC Corporation [NEC]	Toward a safe, secure, and trustworthy implementation of AI in society
	NTT Communications Corporation [NTT Communications]	Smart World realized by communication AI
2021		
3rd Hearing (January 20)	Hidenori Kawamura (Professor, Computer Science and Information Technology, Graduate School of Information Science and Technology, Hokkaido University) [Prof. Hidenori Kawamura (Hokkaido University Graduate School)]	Research case study and start-up at the Laboratory of Harmonic Systems Engineering, Hokkaido University
	Institution for a Global Society Co., Ltd. [Institution for a Global Society]	Protection of personal information that accelerates data-based education with fair evaluation by AI. Human resources development and an education platform
	Aizuwakamatsu City [Aizuwakamatsu City]	The role of AI in "Smart City Aizuwakamatsu"
4th Hearing (February 10)	NTT DATA Corporation [NTT DATA]	NTT DATA Group AI Governance Initiatives, 2021 update
	Oki Electric Industry Co., Ltd. [OKI]	AI Risk Management of OKI
	Sony Group Corporation [Sony]	Sony Group's AI Ethics Activities
5th Hearing (February 19)	Sumitomo Corporation [Sumitomo Corporation]	DX Promotion and AI Utilization in the COVID-19 crisis by Sumitomo

		Corporation
	LegalForce, Inc. [LegalForce]	Introduction of a contract review and management system using natural language processing
	Legalscape, Inc. [Legalscape]	Efforts toward organizing legal information into web-like structure

6th Hearing (March 9)	Nippon Television Network Corporation [Nippon Television]	Introducing the AI utilization case study and AI utilization promotion system of Nippon TV
	NHK Science & Technology Research Laboratories [NHK Science & Technology Research Laboratories]	Efforts to develop AI technology at NHK Science & Technology Research Laboratories
7th Hearing (March 17)	Toshiba Corporation [Toshiba]	Toshiba's AI Initiatives
	FUJIFILM Holdings Corporation [FUJIFILM]	Regarding Fujifilm's AI development and application case studies and establishment of a basic AI policy
	Japan Post Holdings Co., Ltd. [Japan Post]	Efforts to utilize technology in the postal and logistics fields
8th Hearing (April 6)	Stella Place Co., Ltd. [Stella Place]	Development of the AI weather prediction model in high-performance computing and the possibility of its application at the PC level
	IBM Japan, Ltd. [IBM Japan]	IBM Data and AI technologies to support enterprise-wide AI adoption
	Hitachi, Ltd. [Hitachi]	Efforts toward the realization of an AI network society

Note: Affiliations are those at the time of the release. Abbreviations used in this paper are in parentheses.

In this Chapter, based on the descriptions of the overview of the efforts by individual business operators in Section 4 (4. Overview of the efforts by individual business operators) and the summary of the presentations and opinion exchange at the hearings, etc., we composed the descriptions in Section 2 (2. Points of presentations and opinion exchange at the hearings, etc.) in a cross-sectional way by the items of the principles of the AI R&D Guidelines and the AI Utilization Guidelines and by the field of utilization, including COVID-19 countermeasures, from the perspective of "efforts pertaining to AI ethics and governance," "efforts pertaining to AI R&D and utilization" and "efforts pertaining to human resource development." Initiatives across multiple items/fields are described in a manner that assigns them to the most suitable item/field. (Description may be duplicated as reposts in some cases.)

With the aim of promoting "Safe, Secure, and Trustworthy Implementation of AI in Society," we focused on the initiatives whose recognition and solution of issues are thought to be especially worth sharing in order

to provide useful information to people who intend to develop or use AI, people who are developing or using AI but facing challenges, and people who will develop or use AI more actively, for example. Initiatives of individual businesses are compiled in Attachment 3. (Presentation materials are posted on the MIC website.[74])

Please note that the expressions of the description are based on the presentations and opinion exchanges of the actual hearings, etc.

In addition, we organized future initiatives in Section 3 (3. Future initiatives) based on the initiatives of individual business operators and presentations/opinion exchange of the hearings, etc.

The description in this chapter is based on the presentations and opinion exchanges of the actual hearings, but individual businesses are also implementing various initiatives that are not described here. We intend to conduct hearings on initiatives that are not included here as needed in order to help promotion of "safe, secure, and trustworthy implementation of AI in society."

2. Points of the presentations and opinion exchange of the hearings, etc.

(1) Initiatives related to AI Ethics and Governance

Initiatives related to AI ethics and governance by each business operator, etc. were organized from the perspectives of "guidelines and principles," "organization and structure," "security," "privacy," "fairness," "transparency and accountability," "appropriate use," "quality assurance and development review," and "cooperation and collaboration with external parties."

<Key points of best practices>

○ Many AI developers and service providers have formulated and established guidelines for AI governance, using Social Principles of Human-Centric AI, AI R&D Guidelines, AI utilization guidelines *, etc. as a reference. Especially noteworthy initiative is establishment of a basic policy for the utilization of AI as an AI user.

It is desirable for AI developers and users to formulate and establish guidelines, etc. according to the mode of AI utilization and the nature of AI, and to implement and operate them appropriately, while referring to the case studies (motivation, way of thinking, processes, etc.) presented in the hearings, etc.

○ Many business operators are creating internal working groups and specialized teams, forming committees in collaboration with external experts, and establishing internal and cross-group organizations in order to implement and manage AI ethics and governance. Particularly noteworthy are initiatives that emphasize diversity, by means such as bringing together external researchers with different cultural backgrounds and incorporating perspectives from psychology and cognitive science.

It is desirable for AI developers and users to establish an organization and system for the appropriate implementation and operation of AI ethics and governance, referring to the case studies presented in the hearings, etc.

Case studies of the creation of systems that allow risk management related to AI to be accepted within companies without resistance by utilizing existing internal regulations and systems as much as possible are also considered to be helpful in building an organization and system.

○ Many business operators are implementing initiatives that emphasize security and privacy protection.

[74] Available on the website below:
<https://www.soumu.go.jp/main_sosiki/kenkyu/ai_network/02iicp01_04000232.html>

Particularly noteworthy are the initiatives utilizing new technologies such as secure computation and blockchain.

AI developers and users are required to take appropriate measures to ensure security and privacy protection according to the mode of AI utilization and the nature of AI, while referring to the cases presented in the hearings, etc. From the perspective of privacy protection, it would also be helpful to consider case studies for activities such as creation of a mechanism that allows users to select whether or not to use the service, or to choose the personal information to be shared, after understanding the risks.

○ Many business operators emphasize the need to ensure fairness and eliminate bias and are implementing initiatives to establish a system to check for bias and discrimination in the process of AI development and utilization.

AI developers and users are required to make appropriate efforts to ensure fairness and eliminate bias in accordance with the mode of AI utilization and the nature of AI, referring to the examples presented in the hearings, etc. [75]

○ Many business operators emphasize transparency and accountability, and are implementing various initiatives including the use of new technologies in the form of "Explainable AI" (XAI) and initiatives to gain understanding and acceptance through dialogue with stakeholders such as users, in addition to technical approaches.

AI developers and users are required to take appropriate measures to ensure transparency and achieve accountability according to the mode of AI utilization and the nature of AI, while referring to the case studies presented in the hearings, etc.[76][77]

○ Many business operators position AI as a tool for humans to use, and implementing the so-called "human in the loop" operation, in which humans ultimately confirm the AI judgment and use AI as a support, rather than leaving everything to AI judgement. [78] "Human in the loop" is closely related to privacy, fairness, transparency, and accountability, and is a very important point of view when considering the relationship between humans and AI.

It is desirable for AI developers and users to appropriately utilize the mechanism to realize "human in the loop" depending on the mode of AI utilization and the nature of AI, while referring to the case studies presented in the hearings, etc.

○ Many business operators have established processes and rules for conducting quality assurance and evaluation of AI. Specific examples are development of evaluation processes throughout the lifecycle, development of tools such as checklists, and creation of templates for contracts. Particularly noteworthy are the efforts to ensure AI ethics and avoid risks from the previous stage of design by formulating development standards, and efforts to continuously operate AI model data and applications while linking them.

It is desirable for AI developers and users to promote initiatives to appropriately implement quality assurance and evaluations, referring to the case studies shown in detail in the hearings with regard to

[75] There was an opinion that judging sensitive attributes is difficult, which is a matter considered to require attention.

[76] There was an opinion that claiming "explainable AI" when the technical level is insufficient may involve a big risk, which is a matter considered to require attention.

[77] Another opinion that is considered to require attention is: because whether explanation can persuade or not depends on the experience of the individuals, it is considered to be necessary to establish benchmarks and guidelines and require only that their standards be satisfied.

[78] Here, the term is used in the sense of "human participation in part of the judgment and control in a machine or system highly independent and automated by artificial intelligence."

initiatives such as quality assurance.

○ Many business operators are actively cooperating and collaborating with the government, related organizations, external specialists and experts, etc. It is thought that these cooperations and collaborations are deepening the efforts of business operators themselves and contributing to the promotion of social implementation of AI.

It is desirable for AI developers and users to actively cooperate and collaborate with the outside world, referring to the case studies presented in the hearings, and promote the social implementation of AI by multiple stakeholders.

A. Guidelines and principles[79]

[NEC]

○ NEC established "NEC Group AI and Human Rights Principles" in April 2019, while at the same time developing an internal system and implementing employee education.

[Sony]

○ In September 2018, the “Sony Group AI Ethics Guidelines” were released. They defined seven principles with reference to Sony’s Founding Prospectus, Mission/Vision, and the Sony Group Code of Conduct. In March 2019, they were revised to align with Sony’s Purpose & Values. The guidelines consist of positive expressions, rather than expressions of “what not to do.”

[FUJIFILM]

○ The “AI Basic Policy of Fujifilm Group” was established in December 2020. First, it was recognized in the company that discussions on formulation of rules of AI development and utilization are advancing in forums, conferences, governments, ICT and other companies. In FY2020, when the ESG department carried out human right due diligence (inspection of the risk of violation of human rights), the company recognized possible risk of infringement of human rights in AI development and utilization, and a big impact if the risk surfaced. At that time, the ICT department that was conducting development while paying attention to the bias of teaching data was worried about the lack of stipulation. To address the situation, the two departments started to formulate a policy in cooperation.

○ Steps toward the establishment were: (i) sorting out the AI development/use situation in the company and identifying possible risk of AI violating human rights; (ii) checking the trends of general principles of AI, which include trends in Europe, the United States, China and OECD, “Principles of Human-centric AI society” of the entire government, “Draft AI R&D Guidelines for International Discussions” and “AI Utilization Guidelines” of the Promotion Council and AI policies of other companies in Japan; (iii) drawing up the company policy based on mutual recognition on possible risks in the company with departments conducting AI development/utilization, and; (iv) establishing the policy with the approval at the ESG Committee and the Board of Directors.

○ The focus of this policy was to avoid restricting the development and utilization of AI more than necessary. The purpose of utilizing AI is to improve social benefits and solve social issues, and, in this process, the basic stance has been to respond appropriately to problems that may arise. Another purpose is for data providers to read the basic AI policy, rely on and trust the company, and entrust their data with a sense of

[79] Hearings of Fujitsu, NTT Data, OKI and IBM Japan were implemented earlier and included in the “Report 2020.” See Chapter 3 of the “Report 2020.”

security. This policy will be reviewed periodically, and the content will be revised to reflect changes.

[Hitachi]

○ In February 2021, the "AI Ethical Principles" were formulated and a white paper was released to the public. Since Hitachi is responsible for building social infrastructures that contribute to the realization of a better society, action standards and practical items unique to Hitachi have been established, including the phases of planning, social implementation, and maintenance management.

B. Organization and structure

[Google]

○ The diversity of human resources is emphasized, including the fact that the people who provide input are very diverse. This diversity, which includes men and women, is characterized by the gathering of scholars from different cultures.

[Fujitsu Laboratories]

○ With regard to AI ethics, Fujitsu Laboratories Ltd. works in collaboration with various departments in Fujitsu, such as business units, legal affairs, and human resources. Fujitsu Laboratories Ltd. comprises not only computer science researchers but also social science researchers working on psychology, fieldwork, and cognitive science. It is important to include the perspectives of psychology and cognitive science.

[OKI]

○ We set up a working group to check ethical aspects and legal risks when providing AI products, or to study schemes for checking.

○ When considering structures and operations, we basically intend to use existing internal rules and schemes as far as possible. In this way we are constructing a mechanism under which risk management regarding AI can be accepted without resistance in the company.

[Sony]

○ Structure of our AI ethics committee is: a steering committee of executives under which there is a working-level committee consisting of directors of legal, privacy, quality management; and other departments under which there are five working groups (technology, assessment, education, information dissemination and external trend survey). The working-level committee aims to execute the AI ethics guidelines while communicating with individual business units and indirect departments.

[Sumitomo Corporation]

○ It is considered that an internal digital engineering department, even a small one, can try various things that may produce results.

○ Institutional design is necessary for utilization of digital, data, AI and similar technologies. For example, it is important to develop a specialized promotion system, recruit experts from outside and train in-company human resources. Furthermore, the personnel design, personnel system, human resource development and evaluation should be conducted as a package.

[Nippon Television]

○ The AI Liaison Committee was established in August 2020 as a system to promote the utilization of AI. The aim is to create a mechanism for sharing information on the challenges of initiatives throughout the Nippon TV group and to minimize the risk of unnecessary investment. The idea is to freely share AI related information and enhance companywide knowledge and share information on AI projects across the Nippon TV group, while also considering the introduction of efficient AI technology by sharing successful and unsuccessful examples. In addition, it is an equal place for creating new initiatives utilizing AI for employees from various workplaces, including production, to gather and share information.

[Hitachi]

○ We organized a team specialized in AI ethics that promotes in-company training for individual sectors in cooperation with an AI ethics advisory board consisting of external experts and an internal advisory committee on privacy protection.

○ The team specialized in AI ethics is a group of experts with technical backgrounds and belongs to Lumada Data Science Lab (top group of data scientists). Because R&D and social implementation of safe, secure and trustworthy AI requires people with various backgrounds, the team also includes researchers of design and social psychology.

C. Security

[Fujitsu Laboratories]

○ With regard to AI security, with the spread of AI, attacks against AI (such as deceiving AI and stealing AI information) and threats using AI (such as deceiving with AI) are emerged. For example, Fujitsu Research has developed a technology to detect spoofed attacks (that trick AI) with high accuracy by automatically creating training data and using models for each of the characteristics of multiple attacks.

[NTT Communications]

○ Because security influences data reliability, we focus our efforts on security. In our translation service, for example, we make clients' translation files invisible, encrypt them and enable closed network connection. Files are automatically deleted, and translation logs are removed. Furthermore, we don't use client data for AI learning, and we make separate investments for AI learning. We expend all possible means to ensure security, which include file virus scan and IP address authentication.

D. Privacy

[NEC]

○ It is important that data be distributed in a safe and secure manner, and secure calculation techniques are used to ensure that calculations are made in a manner that does not identify individuals. For example, if the data held by a medical institution are encrypted, distributed across servers, and processed using secure calculations, the data can be retained individually. However, as the volume of data used increases, the overall performance also improves, and a new value can be created. In addition, research and development are being conducted on blockchain such that it conveys information reliably.

○ Challenge in face recognition is to drastically raise the technology level and increase its resistance to the usage environment. When providing solutions, it is important to have users understand the solutions. For example, services in airports take the form of opt-in and can be used only with consent for face recognition. Our approach is that the number of users will increase when its advantages including shorter procedure time are known. People who favor the conventional ways can choose the conventional process.

[Institution for a Global Society]

○ Systems can demonstrate the protection of students' personal information in job hunting activities. The system allows student s to enter their grades and activities through smartphones and other devices, and allows companies to view such information, but the student data are encrypted and stored in a decentralized manner. The blockchain is used to make the data traceable, and the students themselves can choose to whom they want to disclose the information (company) as well as the scope of the information. The companies cannot extract information without permission thus personal information is protected.

[Japan Post]

○ Address information particularly requires privacy protection and has been used only for mail operation, but we think it can be used for disaster prevention resilience and safety confirmation with due consideration to privacy. Demonstration experiments are conducted on delivery according to lifestyle by using data from smart meters. It is important to develop a strategy on data holding and utilization to combine privacy protection and data utilization.

[Hitachi]

○ We provide image analysis that visualizes the flow and behavior of people for the safety and security of public space. By displaying persons as icons, we ensure privacy protection in this service. The system that visualizes and distributes congestion information real-time enables checking of the degree of congestion by smartphone/tablet and can be used to counter COVID-19.

E. Fairness

[NEC]

○ There is a problem that reflectance to lighting varies depending on the skin color. Based on such recognition, we are studying how well technologies can address the problem.

[Institution for a Global Society]

○ A big issue in Japan of today is that very few data are available in the education and personnel fields. Even when we have data, we cannot use the past data as they are, because of extreme sexism or excessive bias in various ways. Furthermore, insufficient consideration to the protection of personal information when obtaining the data sometimes gives rise to a problem.

○ When gathering data, we identify discrimination in the data and directly provide education to people conducting the discrimination. We use data for machine learning, etc. after removing discriminatory tendencies as far as possible.

[NTT DATA]

○ In the AI quality control process created by our company, measures have been taken to include a process that checks for bias in the original data using a checklist.

[Sony]

○ Our activity starts from thinking about how to check bias regarding sensitive attributes and the question of what sensitive attributes are in the first place, but this judgment is difficult. For example, when race and gender are found to be sensitive attributes requiring special attention, we check multiple items including possible biases and stereotyped learning.

○ Regarding fairness, we recognize that it is difficult to determine what is considered sensitive. In the areas where it has been identified, we have established check rules and databases for fairness. For example, in the detection of people, we are building a database and tools that check for racial bias.
○ With regard to consideration to diverse stakeholders, we check the consideration given to minority stakeholders including people with disabilities and children, for example.

[Nippon Television]
○ It is said that face recognition has race differences, but players of different countries are correctly recognized in broadcasting of the rugby world cup. It is considered to have reached a practical level.

[IBM Japan]
○ In order to monitor the fairness and performance of the model, rather than monitoring the model during the development phase to detect bias, we are building a mechanism using technology that monitors the AI model during the execution of the operations to detect the occurrence of bias or data drift and to encourage rectification if needed.

F. Transparency and accountability

[Prof. Yasushi Okuno (Kyoto University Graduate School)]
○ Not only in drug discovery but also in medical practice, we think it is important to produce convincing results for users when we extract prediction factors by using explainable AI technology.

Because whether explanation can persuade or not depends on the experience of the individuals, it is considered to be necessary to establish benchmarks and guidelines and only require that their standards be satisfied.

[Fujitsu Laboratories]
○ With regard to explainable AI, the concept of AI that humans can trust, understand, and manage is important, and it is conceivable to respond by explaining the rationale by using a knowledge graph. For example, in the medical example, a knowledge graph can be created from the medical papers and knowledge databases. An explainable AI can identify whether it is possible to create medical and pharmaceutical grounds is input by connecting past medical papers and knowledge databases on the knowledge graph.

[NICT]
○ It is difficult to judge whether AI should be allowed to recommend specific products or services when it speaks to people. This may depend on whether or not the intentions of a private company are included. Technically, we think this is possible only when boundaries are drawn.
○ Claiming “explainable AI” when the technical level is insufficient may involve a big risk: namely, AI may automatically generate convincing justifications as such a regarding inappropriate judgment, and it may spread as an appropriate judgment. Viewed from the opposite side, currently we don’t have an answer to the question of: ‘how to secure validity of explanation or justification presented by Explainable AI?’. If Explainable AI presented the validity of explanation and justification presented by Explainable AI, we would fall into infinite regress.

[NEC]

○ We use terms: black box and white box. Typical example of a black box is deep learning: when we want to radically improve factory operation efficiency, if operation efficiency is improved as a result, we may say this AI is good even when we don't know the content.

With white box, on the other hand, human beings make decisions based on the suggestions made by AI. Very simply put, this is a classification device, a sophisticated system to classify various patterns to produce results. In the case of demand forecast, AI presents that a 'demand like this' will expand under a 'condition like this.'

[Institution for a Global Society]

○ It has become established in global ethical codes that white AI should be used in personnel affairs and education. Consequently, when sophisticated AI is used, we cannot fulfill ex-post facto accountability on why this personnel judgment was made or why this educational evaluation was made.

[Aizuwakamatsu City]

○ It is important to explain in an easy-to-understand manner how AI will be used and what effects will be obtained as a result, so that users, such as citizens, understand and accept it. The use of data is on an opt in basis, and services are provided only after obtaining the consent of the individual. It is important for citizens to be convinced to use AI based services.

○ Sometimes city employees may lack knowledge and understanding of what services they can provide using AI, and what problems they can solve. There is a need for something like study meetings. It is also important to have knowledge and knowhow to communicate the convenience and safety of the services to residents.

○ In some smart city initiatives in the past, users were reluctant at first but gradually opened their minds through repeated talks with the persons in charge, which led to realization of the project. We feel that this is a community that greatly values human relationships. It is important to provide explanation with patience to obtain understanding.

[Sony]

○ We think pursuing transparency is necessary for dialog with stakeholders. This means that we should prepare a mechanism to show the grounds for description of and judgment on the data or model.

○ Dialog with stakeholders is the process of sharing possible benefits and losses, namely sharing understanding of negative accountability impacts on stakeholders, which are related to the benefits of the stakeholders, and building a system for this purpose.

[IBM Japan]

○ With regard to trust, the past focus was on improving the precision of prediction. Today fairness and explainability are also required. Through dialogs with customers, we strongly feel that companies are required to conduct explainability and accountability.

[Hitachi]

○ Since fair judgment is required for the application of AI for mortgage screening, Explainable AI (XAI) is used to explain the basis for the decision. By using this XAI to provide the basis for the decision, both the reviewer and the reviewee can use the AI with confidence.

G. Appropriate use

[NEC]

○ For safe and secure town development, we conducted a demonstration in private land and installed smart streetlights. We formulated a guideline for this demonstration based on guidelines for utilization of camera images, while taking into consideration the Personal Information Protection Act and expert opinions. At the same time, we made the content of the guideline known to the shopping malls and relevant people beforehand and made announcements during the experiment. Introduction of new things involves various risks, but it is important to realize them while ensuring maximum risk management.

[Institution for a Global Society]

○ Especially in the fields of education and human resources, it is dangerous to entrust the work completely to AI. AI should only be used as a n auxiliary tool, and the final decision should be made by humans. Globally, the ethical direction regarding the difficulty of using AI decisions as an auxiliary tool without a clear understanding of why the decisions were made the way they were has emerged.

[Aizuwakamatsu City]

○ We think that both ICT and AI are tools to enrich people's lives and make them happy. We will hold this human-centered viewpoint in focus.

[OKI]

○ AI is good at activities that can be stylized or formulated. Desirable role sharing may include leaving preprocessing of entry sheets and other tasks to organize typical parts for drafting and tasks that require objective assessment avoiding subjectivity to AI, while human beings make evaluation based on the results.

[LegalForce]

○ Contract review cannot be completely left to AI. Final judgment is made by human beings. For this reason, we think that, assuming legal knowledge, use of AI may fit the need to do contract review quickly and without errors of omission.

[Nippon Television]

○ Regarding the automatic summarization of AI manuscripts, the system is still in the experimental stage however, it is envisioned that the system will first automatically create a summary, and then a person will check the result and make corrections before posting it on the website or sharing it on social media. The intent is not to distribute or air the results of AI summaries as they are, but to have a person perform a final check; it is operated in this manner under such a policy for any AI. The idea is to maximize AI as much as possible, but only to support humans.

[NHK Science & Technology Research Laboratories]

○ With an automatic manuscript preparation system, we obtain various data to use for reporting and prepare news drafts based on the mass of manuscripts prepared in the past. For example, when we select river water-level information such as "reaching a dangerous water level" or current water level, the system can prepare a draft corresponding to the information. Based on the draft prepared by the system, human editors determine the need for correction or deletion and prepare the final manuscript.

○ In subtitle creation by voice recognition, recognition errors are finally corrected by human beings before broadcasting.

[FUJIFILM]

○ Under certain conditions, diagnostic imaging AI can have higher detection rates than medical specialists. However, instead of letting AI make decisions, it is positioned in a support role for doctors. The product incorporates a device that does not disrupt the relationship between the doctor's diagnosis and the AI diagnosis to confirm the results.

H. Quality assurance and development review

[Fujitsu Laboratories]

○ AI that was usable sometimes becomes unusable due to changes in data characteristics after starting service provision. (In the case of credit risk assessment, for example, 91% accuracy at the time of learning deteriorates to 69% in one year if nothing is done.) How to operate AI is a big challenge. To address this challenge, we can use technologies of "automatic monitoring of accuracy degradation" and "automatic restoration of accuracy." (In the case of credit risk assessment, degradation prediction error is 3% and accuracy can be increased from 69% to 89% through automatic restoration.)

○ Lifecycle is very important in quality management, which is not limited to operation. It is a very important research theme for venders providing AI to properly define quality and implement lifecycle quality management in addition to the quality during test and development stages.

[Google]

○ The Responsible Innovation team is formulating various rules and policies for trust in conformance with AI principles. In addition, the company provides guidance to teams on how to emphasize AI principles and develop educational materials to help all employees understand and deal with the complexities of AI principles and the problems they address. In addition, it serves as a hub of specialized knowledge on a variety of topics, providing information internally on cases such as AI ethics, social risk research, and human rights.

○ The Central Review Team identifies the AI principles to be applied, and then the review team asks appropriate internal product, ethics, fairness, security, privacy, and other experts to gather specific guidance. Then, the reviewer considers the seriousness of the benefit s and damages, the likelihood that a benefit or damage will occur, and asks questions and conducts checks that reflect AI principles. Subsequently, the product research team conducts a technical evaluation according to the technology (for example, examining fairness for new models of machine learning), and, if necessary, consults with an external expert and makes the necessary adjustments to the product.

○ When a difficult ethical problem has occurred, a higher council comprising executives conducts final review and decides how to proceed. In other cases, the Central Responsible Innovation Team makes the final decision, catalogs, and communicates the decision to relevant people. These decisions are accumulated as precedents.

○ It is important thing to bear in mind that this process requires regular repetition. Because we don't have the answer to everything, we must learn from individual cases and gradually build a system. What we learn in basic research and product development will be used for design of the entire process and development of tools to help subsequent research, product improvement and realization of AI principles.

[NTT DATA]

○ Following the formulation of AI guidelines, we developed a system of AI governance and technology. We created a philosophy for the AI guidelines; for it to take root in the field, it is necessary to develop some tools and techniques. We therefore constructed an AI development methodology. This is a methodology that provides “knowledge and processes,” “development standards,” and “quality assessment tools” so that the person in charge of the system development project can develop an AI system based on the AI guidelines.

○ We are handling about 300 AI projects and have consolidated the knowledge and developed a management process which each AI system developer and person in charge of the project can refer to in the development process. Since definitions of processes alone are difficult to apply for each project, we created samples of specific deliverables, required documents, and templates. In addition, AI quality is also important; we therefore prepared an assessment tool that allows evaluations to be conducted by using simple checklists and questionnaires. As an AI development methodology, we prepared a document that integrates the AI development knowledge, AI development process, AI management process, AI development standard, and AI quality assessment tool.

○ It is significant that we have defined the processes of AI development. We defined the roles and human resources (business analyst, data engineer, data scientist and machine learning engineer) necessary for AI development and explained the key tasks of these human resources in each process.

○ We identified and systematized necessary control items of AI management process based on Project Management Body of Knowledge (PMBOK). As major characteristics of the process, we assume two stages: model development (PoC) and system development (Systematization).

○ The point of our approach to AI quality assurance is that testing of the specifications alone does not necessarily guarantee the quality of the AI system. The quality must be considered comprehensively such as the characteristics of AI (model and data quality) as well as the characteristics of the software (use and product quality).

○ For AI quality management, we developed project inquiry forms and checklist along the flow of “project planning,” “implementation” and “retracement” and created a mechanism for self-check of possible risks when starting a project.

○ We provide a service where in-company experts supply feedback regarding AI quality assessment tools by using a function to report the results of the checklist and assessment of individual projects. Regarding the approach of AI quality assessment, we organized about 80 check items for each phase of AI design, data preparation and AI construction and evaluation from the viewpoint of system development.

○ Through these activities, we conduct PoC from the AI development and field points of view. This has an effect to clearly indicate specific approaches and solutions to address vague uneasiness. Other effects are improvement of project efficiency, quality and productivity.

○ Using the AI quality assessment tools, we could discover risks in actual projects. For example, there is a case where a model was created using data different from the data during operation and accuracy is insufficient because we failed to clarify the AI use scenario at the start. The risk assessment clarified the problems.

[OKI]

○ The company including salespeople, system engineers, developers and researchers compiled an AI contract guideline organizing the promises to be made with customers, activities in the company and things that should be noted during each stage from customer consultation to product provision.

With reference to the guidelines of the Ministry of Economy, Trade and Industry[80] we created AI contract patterns (for each stage of technology applicability before PoC, PoC and formal agreement) by identifying promises to make to prevent materialization of risks unique to AI and adding these to the existing model contracts.

○ With reference to the guideline of QA4AI Consortium[81] we sorted check items in quality activities and compiled an AI quality checklist in line with the OKI development process. We also created a user's guide and glossary for this checklist.

○ In order to prevent risk materialization, we conduct regular monitoring to make inquiries to individual departments to check the progress of measures and identify challenges. We also make the issue known in the company through e-learning on compliance, distribution of case examples and posting on the house journal.

○ We are reinforcing quality management so that it can support AI products, centering on the quality management system operated in the existing solution business. At the stage of contracting with customers, the company refers to the AI contract guidelines, contract templates, AI quality checklist, etc.

○ In order to identify ethical and legal risks of AI, we have introduced a mechanism of AI ethics check. Using the mechanism, the AI supervisory group checks what kind of data is handled, whether or not the data include personal information and identifies risks in cooperation with experts of the legal, intellectual property, business and sales departments. For legally complex cases, we ask cooperation of specialized lawyers.

[Sony]

○ The AI ethics assessment process has an iterative part in actual agile development, but the typical process consists of planning, development, mass production, sales and release. In this process, we have events in the quality management system. For example, we conduct assessments by checking AI ethics before the design stage toward AI Ethics by Design.

○ Our assessment sheet includes detailed check items for the planning stage and the start of development/design. Finally, we check whether these items are duly executed or not. After release, we also check incidents in the market through monitoring.

[Toshiba]

○ We have established AI quality assurance guidelines in the company and constructed a system to provide high-quality AI based on the guidelines. We are promoting utilization of AI in social infrastructure by making full use of technologies including explainable AI, AI particularly effective for social infrastructure, AI operating on the edge side and AI regarding human beings.

[IBM Japan]

○ Rather than just creating a one-time application, a cycle of growth is being established by incorporating new requirements frequently. In this cycle, new applications generate new data. It is necessary to continuously develop the AI model using newly generated data, and it is important to operate the two continuous delivery cycles of "continuous delivery of applications" and "continuous delivery of data and

[80] METI "Contract Guidance on Utilization of AI and Data" (August 2018)

[81] "Guideline for Quality Assurance of AI-based products and services" (May 2019) of the Consortium of Quality Assurance for Artificial-Intelligence-based products and services. The guideline was revised in February and August 2020. See Chapter 1, 1. (7).

AI" in both directions.

○ We think that the present realistic solution is to support users while taking advantage of AI technology rather than automating the entire delivery cycle, because doing the entire cycle manually would take man-hours, time and costs.

○ "Continued delivery of data and AI" is a cycle of trials on what kind of data to use to develop what kind of applications and AI solutions. The environment for these trials does not require a very high service level. However, when applying a model promising a certain accuracy to actual services, a very high service level is required for the runtime environment of the AI model used for the actual operation and deployment environment. It is important to separate the service level of the two types of environments.

[Hitachi]

○ We manage behaviors of AI models by providing development/operation support infrastructure also after starting actual operation of AI systems. We continuously monitor input data and results based on the rules set beforehand. When there is an abnormal data or result, degradation of prediction accuracy of the AI is prevented through automatic detection. We conduct R&D under this scheme based on the AI ethics principles to promote swift social implementation of the latest research results, while at the same time working for appropriate operation and quality assurance.

I. Cooperation and collaboration with external parties

[Google]

○ In the practice of the AI principles it is important to learn from internal and external experts through honest and continued dialogs with users, government officials and other stakeholders.

○ We work with externa experts, as well as scholars and minorities, and listen to their perspective regarding AI principles, their practices, and reliable products. It is very important to collaborate with the outside world to understand what users and society want, and to incorporate that into our daily development.

[NEC]

○ Since we need to listen to various opinions on these issues, we also organize dialogues with external experts. Based on this, it is important to create something to earn trust while also considering technology in terms of human rights and privacy; we are therefore engaging in such activities. activities.

[Prof. Hidenori Kawamura (Hokkaido University Graduate School)]

○ We are characterized by the fact that we are conducting extensive joint research with companies in order to perform research not only from a laboratory but also from an outside perspective in response to the issues that companies are facing and the data that only companies possess. We have collaborated with companies of various sizes, ranging from large corporations to venture companies.

○ About management of joint research by universities and companies

- Because AI is a technology wanted by society, we carry out projects keeping contact points with society in mind, by utilizing the involvement of external participants rather than using a closed group of students and teachers, and by treating students as independent adults.
- In order to proceed to higher education, students need to produce results such as conference and paper presentations. For this reason, we divide projects and clearly declare to the companies that this is

research of the university conducted as part of its education and research. On the other hand, teachers also consider results on the company side and ensure management with proper balance of both sides.

[Sony]

○ We are being proactive in external collaboration, as we believe that there are aspects that we cannot solve on our own. Thus, in addition to the activities included in the material, we participate in activities such as "ISO / IEC JTC1 / SC42.[82] We also cooperate and collaborate with "Business for Social Responsibility (BSR)," Microsoft and other partners.

○ We organize symposiums and lectures by specialists and dialogs with experts in and outside the company. Information from these activities is shared and disseminated through our enterprise information portal. We also disseminate information through external websites and organize external collaboration.

[Legalscape]

○ First, with the aim of collecting all information accessible as electronic data, we are digitalizing information using our own patented technology with focus on laws and regulations, PDF materials posted on websites and book data. The next stage will be collaboration with courts and government offices. We think that if we can compile a database of paper materials including judgment documents stored in individual courts and materials held by government offices, we will get closer to the realization of our vision: a landscape that organizes all legal information for viewing at a glance.

[Stella Place]

○ We added up satellite information and radar information while comparing them numerically using a specific calculation method. In this way we followed physical phenomena alone in a manner faithful to the system by looking at how figures captured from meteorological satellites are expressed as a cloud and how they move, and thus developed an AI model based on numerical values alone rather than images. We ask weather forecasters to review the images processed by this AI model and are working to improve the model while getting input from weather specialists.

[Hitachi]

○ It is important to improve our sense of human-centered ethics perspective through discussions with external experts. We discuss AI ethics in regular meetings of company-wide subcommittees including business departments and laboratories. Several times a year we invite external experts for wide-ranging and honest opinion exchange on how AI is recognized in society and what requires attention. Through these activities we raise our sensitivity in conducting R&D, social implementation and utilization.

(2) Initiatives related to AI Development and Utilization

Among the initiatives for AI development and utilization taken by each business operator, we have organized efforts related to "countermeasures against COVID-19," "medical and healthcare," and "the elderly and people with disabilities" as fields that require special attention, given that the spread of COVID-19 continues, and that it is important to disseminate information internationally as a country that has faced issues in advance.

[82] One of the Subcommittees (SC) set up as an organization for international standardization under the Joint Technical Committee 1 (JTC1) that was jointly established by the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

<Key points of best practices>

○ As AI-based countermeasure against COVID-19, many business operators are implementing initiatives such as avoiding conditions of overcrowding and close contact, and providing chatbot services. In particular, AI-based drug discovery attempts are worthy of attention, and there are great expectations that these will shorten the time and cost of drug development.[83]

It is desirable for AI developers and users to continue to promote initiatives for COVID-19 countermeasures that utilize AI, while making reference to the cases presented in the hearings and basing the initiatives on the status of the spread of COVID-19. In addition, there are opinions that in the New Normal, it is necessary to improve the management structure and maintain supply chains in "the New Normal". These issues are also expected to be resolved by utilizing AI.

○ In the medical and healthcare fields, initiatives utilizing AI to support diagnoses by doctors and prevent lifestyle-related diseases are worth noting.

It is desirable for AI developers and users to promote initiatives to utilize AI in the medical and healthcare fields, referring to the case studies presented in the hearings.

Specifically, in a situation in which the COVID-19 continues to spread, as suggested in the hearings, it is expected that the utilization of AI will promote initiatives to reduce the number of patient visits to hospitals, propose optimal treatments for individuals, reduce the burden on medical sites, and economize the labor force.

○ Cases in the nursing care and broadcasting fields are presented in the hearing. Initiatives to support the elderly and people with disabilities by utilizing AI are worth noting.

Because initiatives to support the elderly and people with disabilities are expected to increase their importance and necessity in Japan, it is desirable for AI developers and users to promote initiatives to use AI to support them, referring to the cases presented in the hearings.

A. AI Development and utilization as COVID-19 countermeasure

[Prof. Yasushi Okuno (Kyoto University Graduate School)]

○ We searched for a drug for COVID 19 using the supercomputer Fugaku Specifically, we searched for therapeutic drug candidates to suppress proteins related to COVID 19 proliferation from about 2,000 existing drugs by molecular dynamics calculation, which is a type of molecular simulation.

○ Simulating moving protein while clearly showing water involves very high calculation cost and therefore requires a supercomputer. Simulations of moving protein that is made to hold drugs in water are difficult calculations even for supercomputers. Because machine power increased a hundredfold from "Kei" to "Fugaku," we can carry out computer experiments of several thousands of chemical compounds.

○ In ordinary drug discovery experiments, we culture cells, sprinkle drugs and see whether the virus stops growing, but the process takes as long as several months. However, computers can conduct simulations in a short period of time. In this simulation of therapeutic drugs against novel coronavirus, 2,128 kinds of drug candidates were used and ranked. When appropriately combined, some of the top-ranking candidates in the simulation using Fugaku are also highly evaluated abroad, which shows that calculation of Fugaku is not haphazard.

The simulation that would normally take several months was calculated by Fugaku in 10 days. In April, when the simulation was conducted, Fugaku was still in the state before tune-up of applications. Now

[83] It is said that drug development involves a cost over 100 billion yen and takes more than 10 years. (See the presentation materials of Professor Okuno (Graduate School of Kyoto University Graduate School)

after the tune-up, simulation of 2,000 kinds of drugs that formerly took 10 days now can be completed in 2 days.

○ Drug discovery takes many years and involves high costs. The process starts from the search for drugs, and through optimization, animal tests, and clinical trial on humans, the drug is finally used as therapeutic medicine in medical practice. However, existing medicines can be used for human beings by skipping the middle processes because it is known that there is no toxicity or side reaction problem.

○ In conventional drug discovery, once a hit compound is found, experiments are conducted to check whether the compound avoids toxicity, has medicinal effects, has side reactions, etc. The synthesis is repeated many times until the final product is non-toxic, highly absorbable, and metabolically stable. The long period of time and the high cost are the challenges in drug discovery; therefore, efforts are underway to use AI to mitigate these issues and to design compounds.

○ Now we are becoming capable, after a fashion, to make AI find chemical compounds that bond with a certain protein or think of compounds that do not have toxicity. With this capability, we would not need simulations by supercomputers and we would be able to design chemical compounds, but this is difficult in the case of COVID-19. In the case of COVID-19, there are almost no past cases; it is not possible to create AI based on past cases. Then, do we need experiments as before? We believe that one strategy would be to make simulations using “Fugaku” and skip experimenting. We are conducting research with good combinations in mind while conducting simulations using AI.

[Fujitsu Laboratories]

○ For economic activities and R&D to support life in the New Normal, we need survey and classification of specific challenges not only on the seeds side but also on the user side. Not only research of seeds but also fitting with the needs side is also important.

[NTT Communications]

○ This is a case study of the introduction of chatbots to handle inquiries of local governments. The time required to respond to inquiries about COVID-19 has been reduced, allowing governments to focus on other types of work or to respond 24 hours a day. Chatbots can also provide a service that translates inquiries from foreigners who cannot speak Japanese; the translation is provided while the caller is speaking. When it is not possible to interact via chatbot, an operator will respond; however, if the operator can only speak Japanese, the interaction can be handled via chatbot.

○ We detect moving routes of infected people, feverish people, congestion level and mask wearing. For example, by installing cameras in offices, we can restrict admission based on the judgement of the congestion level in the facility, or detect people not wearing a mask at the entrance and display a message to wear a mask.

[Aizuwakamatsu City]

○ We provide AI chatbot service that can answer inquiries about garbage collection, and location of snow-removing vehicles, etc. Since June 2020, it can answer inquiries about COVID-19: available supports, and contact details when infection is suspected, for example.

[NTT DATA]

○ Our initiatives regarding safety/crisis management in the workplace to counter COVID-19 include development of AI that analyzes who took what action and touched what in the office based on videos.

[OKI]

○ In the new normal, it is necessary to accelerate technology development in the light of the acceleration of manpower saving and AI introduction in operations, need for forecasting systems in response to big changes in society (discontinuous changes that make past data unusable) and need for maintaining supply chains across industries. With regard to maintaining supply chains, in particular, we think that it will become necessary to increase their resilience to return to the normal state after cutting off of a part due to earthquake, etc. or global disruption caused by COVID-19.

[Sumitomo Corporation]

○ While the spread of COVID-19 continues, corporate performance and the economic environment are improving. However, non-digital operations and management structures are still required. It is therefore important to utilize digital and AI to reduce costs and improve productivity. In addition, it is necessary to seriously consider increasing the success rate of new businesses; it is important to select projects and focus resources for new businesses. Furthermore, it should be possible to use AI to remotely negotiate and coordinate with those who understand local operations and businesses f or overseas projects. It is then expected that the number of successful cases will increase.

[Toshiba]

○ There is a need to determine the number of people in a crowd (crowded conditions). With crowd measurement AI, it is possible to detect the number of people in a crowd from camera images with very high accuracy. By deploying this system at stations and downtown areas, various social implementations are being promoted by checking the crowd density information from time to time.

○ Remote work, online lessons and other online activities are rapidly progressing. Because many universities have introduced online activities, we deploy solutions to recognize the spoken words of lessons real-time and convert them to characters and are conducting demonstration experiments in remote work of universities.

[FUJIFILM]

○ In order to conduct COVID-19 diagnosis in remote places of emerging counties and areas with a shortage of doctors/hospitals, we used small X-ray devices equipped with AI. In back regions where large X-ray cars cannot enter and areas without power sources, we can use a small rechargeable X-ray device to make mapping and diagnose pneumonia. By conducting the PCR test only when pneumonia was diagnosed, we enabled labor- and time-saving COVID-19 diagnosis in remote places.

[Hitachi]

○ We provide image analysis that visualizes the flow and behavior of people for the safety and security of public space. By displaying persons as icons, we ensure privacy protection in this service. The system that visualizes and distributes congestion information real-time enables checking of the degree of congestion by smartphone/tablet and can be used to counter COVID-19. [cited previously]

B. AI development and utilization related to medical/healthcare

[Prof. Yasushi Okuno (Kyoto University Graduate School)]

○ Benefits of medical AI include reduction of the number of patient visits to hospitals and proposal of optimal treatments for individuals, which can suppress unnecessary treatments. It is also said that it will

reduce the burden on medical sites and economize the labor force.

○ Improvement of the efficiency and sophistication of medical care using AI are key to “life with corona” and said to be important for delivering medical care safely under COVID-19 or for preventing medical care breakdown. While digitalization in medical care is emphasized, we think that data are also essential for COVID-19 countermeasures.

[Aizuwakamatsu City]

○ In the demonstration in the healthcare field, AI was used to determine the risk of developing lifestyle related diseases (hypertension, diabetes, and dyslipidemia) based on the results of specific medical examinations and other data. At the same time, the amount of activity was measured based on information from wearable devices, such as pedometers, and behavioral change was encouraged. The results showed that 95% of the users increased their health awareness and 89% changed their health behavior.

[Toshiba]

○ We started a service to predict the risk of developing six lifestyle-related diseases (diabetes, hypertension, obesity, dyslipidemia, liver dysfunction, and renal dysfunction) from medical examination data. For example, by inputting one year of examination data, AI will show the risk percentage of developing diabetes for the next five years.

[FUJIFILM]

○ The foundation of AI utilization in the medical field is the Picture Archiving and Communication System (PACS). Global spread of our PACS that is a platform for management, storage and sharing of data of CT, X-ray and ultrasonic images enabled wide and swift deployment of AI diagnosis systems.

○ Putting an AI diagnostic platform on PACS to semi automate the workflow of doctors. By using AI to semi automate the four step workflow of “visualization,” “detection,” “classification” and “reporting” after an examination, the goa l is to reduce the burden on doctors so that they can spend more time on patient care and other tasks.

○ AI is not yet at the level of diagnosing all diseases, but instead detects specific disease based on X-ray, ultrasonic and endoscope images. Currently we are developing technologies of COVID-19 AI image diagnosis support.

C. AI development and utilization pertaining to the elderly and people with disabilities

[NICT]

○ By leaving a part of nursing care monitoring to AI, we can reduce the burden on care managers who are in short supply. Furthermore, as a COVID-19 countermeasure, interposition of AI can prevent 3C’s (closed spaces, crowded spaces and close-contact settings) to reduce infection risk.

○ Lack of communication is pointed out as a factor to worsen health conditions of the elderly. Many elderly people want conversation with people and seek communication. In an attempt to solve the issue by chatting with AI, a system equipped with a camera is developed to read emotions from facial expressions and gestures of the elderly in addition to voice. It is expected that introduction of AI into care monitoring will enhance the function to check health conditions and improve the quality of care.

Care managers say it is nice that they do not need to enter the data of dialog results. According to them, entering health conditions into the database on a computer after one or two hours of dialog was stressful. Because voice data directly flow into the database, we think that it will reduce burden on care managers

and contribute to digital transformation.

[Aizuwakamatsu City]

○ In the demonstration for preventing abuse of the elderly (demonstration of the use of AI to identify potential targets of support—that is, those who may be suffering from domestic violence, abuse, lonely death, etc. —from information on welfare operations in order to strengthen support such as watching over them), big data related to abuse (household composition, age, income, disability status, etc.) was provided by the Ministry of Health, Labor and Welfare. After analyzing the tendency of high abuse using AI, we entered the data of the cases of actual households in the city and scored the possibility of abuse. Therefore, it was possible to obtain results with a certain degree of accuracy, as many of the cases that were recognized by AI as having a high possibility of abuse corresponded to actual abuse.

[NHK Science & Technology Research Laboratories]

○ In our universal service, we are working on automatic captioning, voice guide and sign language CG as human-friendly broadcast technologies.

○ We started captioning by voice recognition in 2000. When direct voice recognition is inadequate under a noisy environment, we repeat the utterance in the studio to ensure clear recognition.

We are experimenting with automatic voice recognition captioning of local news to examine the level of correctness of captions totally based on automatic recognition. We are conducting experiments concerning whether dialects can be recognized correctly. We hope to use the results for specific services.

○ Our AI reporter learned news reading of NHK announcers and read manuscripts in a news show.

○ With regard to automatic production of weather information program on the radio, we are tackling a technology to communicate weather information with a natural and smooth synthesized voice by taking advantage of knowhow of NHK announcers who communicate weather information on the radio.

○ With regard to the automatic addition of commentary audio to broadcast audio, we are researching a system that enables visually impaired people to enjoy live broadcasts by automatically generating commentary audio to complement the program and overlap ping it with the broadcast audio.

○ Regarding the generation of sign language content using CG, currently, the number of sign language broadcast s is not increasing due to the lack of sign language newscasters. However, since weather and sports are easy to handle because of their many standardized expressions, work is being done to provide sign language CG services in these fields.

(3) Initiatives related to Human Resource Development

As the shortage of human resources related to AI has been pointed out, and the training and securing of human resources has become an issue[84], we summarize the initiatives taken by each business operator regarding human resource training[85].

<Key points of best practices>

○ Many business operators are focusing on human resource development using e-learning and online

[84]"AI Strategy 2021" (Follow-up to "AI Strategy 2019") also states: "development and securing of relevant human resources is both an urgent task and long-term task including elementary, secondary and higher education, recurrent education and lifelong education."

[85] Some business operators use the term "human asset" instead of "human resource." This report follows the original expression.

resources. There are also initiatives to develop human resources after establishing collaboration with universities and dividing levels in detail. These efforts are thought to be helpful when considering principles and methods of human resource development. Particularly noteworthy are initiatives to provide AI literacy education to the outside world. We hope that such initiatives will lead to raising the levels of AI literacy for business partners and the industry as a whole.

In order to improve the technical strength and international competitiveness of Japan, human resource development is an urgent issue, and it is desirable for AI developers and users to strongly promote initiatives to develop and secure AI human resources, referring to the examples presented in the hearings.

[Fujitsu Laboratories]

○ We are implementing a program where all Fujitsu employees can enroll in e-learning on AI ethics.

[Google]

○ Our in-company training is implemented in combination of training courses and online materials for self-study, which can be used by all employees.

○ We include an educational program on responsible practice in basic training of various roles such as product manager and software engineer. With regard to technology and ethics, we seriously study fairness of machine learning, human-centered design and other topics based on wide-ranging discussions.

[NEC]

○ The company provides AI literacy education for external users and also creates and provides various types of programs for university students, working adults, and researchers.

○ Regarding in-company training, particularly because we use biometrics, we have all employees learn privacy and human right risks periodically through an e-learning program to ensure their recognition. Because the knowledge cannot be learned in one session, all employees learn once a year on a continuing basis. All employees need to pass tests to complete learning. We gather data of the training and obtain information by means of questionnaires and will monitor the change in knowledge level based on their analysis.

[OKI]

○ We have defined human capital levels and created portfolios. We created a training system for each level and type of work, and are providing training to raise the level of skills throughout the group.

○ For AI literacy education, we are developing an e-learning program for all employees, and more than 7,000 people have taken the course. In addition, we made videos explaining the points to consider in AI business and the AI contract guidelines, and are using them in AI sales education, AI engineer education, and AI business education.

○ AI business education, workshops on risk checking are conducted so that participants can experience it themselves. In addition, in terms of AI engineer education, we are focusing on classroom based learning and are also collaborating with universities for practical education. The aim is to increase AI human resources by having university faculty members provide practical training to employees based on their projects.

[Sony]

○ For education and awareness, e learning was introduced in 2019 as mandatory for all employees who are

eligible. It is introductory, and includes what is AI ethics, AI ethics incidents that occur around the world, and the outline of Sony Group AI Ethics Guidelines, the outline of data compliance, especially how to collect data, and how to be aware of bias.

[Sumitomo Corporation]

○ For agile development, we are trying to employ engineers with experience as an IT architect, full-stack engineer, etc., but we find only a limited number of ideal candidates in the market. We have been proclaiming agile development in the past 10 years, but we are yet to acquire people who can do this. The difficulty may be a problem of the entire IT service industry, which requires improvement.

[Toshiba]

○ Human resources within the company are very important in promoting the use of AI. In order to create and realize human resource development plans as a group, an internal AI engineer training program was developed in collaboration with universities, and includes intensive and specialized AI education and training. This training is continuously implemented, and engineers who have never been exposed to AI before are now able to develop AI models and design systems by taking this course, which is being deployed internally.

○ In order to increase the scale of the business, we need to increase human resources for development on the business side and are therefore expanding practical education.

○ Academic theory of machine learning is not necessarily required for everyone. We focus on ability to use core engines provided through cloud and open source. Because there are various education courses and materials, we are developing human resources who may not understand the theory of machine learning and pattern recognition but can create business solutions by applying the technologies to actual problems.

○ It is difficult to employ people who can handle AI from the beginning not only in Japan but also globally. Because it is difficult to employ over one thousand people from the outside in order to increase our AI human resources to 2000, we intend to change other IT engineers of the company to AI human resources in most cases.

[IBM Japan]

○ In Japan, unlike in the United States, client companies do not employ a large number of data scientists. For this reason, we support clients by providing service for human resource development in addition to tools and systems. In addition to data scientists, we also help establishment of a team of people who manage data governance in the client company.

[Hitachi]

○ We established Lumada Data Science Lab that unifies the business division and R&D. By combining consulting and proposal adaptation capabilities of the business side with the AI technology of the R&D side, the lab has already received several orders.

○ Regarding the training of data scientists, we have divided scientists into three tiers Gold, Silver, and Bronze and are working toward improving their levels and developing digital transformation human resources (3,000 people in total). The Gold level consists of top data scientists who tackle advanced is sue s and create new methods; open innovation is actively used to hone technology and people. The Silver level consists of leaders in the data analysis business of each business unit; people from internal business units are accepted and trained through OJT. The Bronze level consists of people responsible for data

analysis practices, leveraging a development program created by Lumada Data Science Lab. to provide opportunities for skill improvement

○ For ethics of engineers, it is important to foster culture. The top management takes the initiative to establish high ethical standards through self-improvement at Hitachi Professional Engineers Association and education of young people. We also established a new company to maximize happiness through AI.

3. Future Initiatives

(1) AI Ethics and Governance

The hearings show that many business operators are advancing development/establishment of guidelines on AI ethics and governance, development of organizations/structures, development of a mechanism for quality assurance, appropriate cooperation with external stakeholders and other initiatives. These can be considered to be excellent initiatives that respond to security, privacy, fairness, transparency, accountability and other principles of the AI R&D Guidelines and the AI Utilization Guidelines

Notable approaches include "by-design" to incorporate AI ethics/governance in the development method, and initiatives with awareness of the importance of AI ethics/governance across companies and groups including business partners and the industry. The hearings showed that these initiatives were advanced as concrete measures. These are considered to be excellent initiatives for "Safe, Secure, and Trustworthy Implementation of AI in Society" beyond the scope of the AI R&D Guidelines and the AI Utilization Guidelines. It is considered that the AI developers and users who are taking these measures fulfill their social responsibility. As a result, rise in their public esteem is expected. In addition, it is hoped that the spread of these initiative over the entire society will increase the social acceptability of AI.

Social change by AI is still in the earliest stage. In order to pursue appropriate implementation of AI in society, it is important to do the following initiatives in the future in the light of the hearings.

(i) Disseminating and sharing case studies on initiatives

Through the hearings, many specific examples of initiatives for AI ethics and governance were presented.

Attention must be paid to the fact that the initiatives presented in the hearings are not necessarily useful or beneficial for all business operators: it depends on the type of AI and service to develop or use, scale of the business, industry type and other factors. However, initiatives common to many business operators are considered to have standard content that will serve as a useful reference for AI developers and users who plan to advance their initiative. "By-design" and supply-chain-wide or industry-wide initiatives are considered to be useful or beneficial for developers and users who have already implemented a certain initiative in order to spread more advanced initiatives. Furthermore, it is hoped that dissemination of information of the efforts on AI ethics/governance by AI developers and users will increase social acceptance of AI.

It is important to disseminate and share case studies on the initiatives taken by each business operator, etc., which are compiled in the report. The Promotion Council (including the AI Governance Review Committee, the same hereinafter) and MIC will promote activities to disseminate and share these in cooperation with external stakeholders.[86]

[86] For example, MIC in cooperation with the ELSI center of Chuo University disseminated and shared the initiatives of the Promotion Council at the symposium held by the center in July 2021.

When promoting activities to disseminate and share the initiatives, it is important to enhance trust in AI and increase social acceptability by promoting initiatives on AI ethics and governance by multi-stakeholders. It is of particular importance to incorporate opinions of users and experts, while expanding the scope of activities to users and user groups.[87] With this objective, we will exchange opinions with a broad range of stakeholders including users, user groups and experts.

"AI Strategy 2021" (Follow-up to "AI strategy 2019") states: "when lifestyles and working styles of people are changing, in order to respond to changes and at the same time improve the operational efficiency of the national government administrative organs and provide high-quality administrative services, we should consider active AI utilization more than before. When national government administrative organs use AI, it is necessary to promote introduction of AI based on the understanding of the importance of transparency, fairness and explainability, in particular. For this purpose, it is necessary to summarize the basic approach of AI introduction in national government administrative organs, formulate comprehensive measures including development of guidelines for AI introduction and implement the measures." In light of the statement, it is expected that AI utilization will be advanced in administrative organs. With this in mind, we will exchange opinions with relevant government offices.

(ii) Dissemination and sharing of the AI R&D Guidelines and the AI Utilization Guidelines and consideration of their review

A. Dissemination and sharing of The Draft AI R&D Guidelines for International Discussions and AI Utilization Guidelines

"Report 2020" states that formulation of AI principles itself does not directly bring revenue to the company but the principles present the company's basic policy on AI development, etc. The report suggests that for its stakeholders, AI principles will dispel concerns about AI development and help to build confidence in its AI development and other activities. In the hearings, there are cases of using the AI R&D Guidelines and the AI Utilization Guidelines as a reference for developing their own guidelines. In addition to disseminating and sharing case studies of the initiatives taken by business operators, etc. of (i) above, the Promotion Council and MIC will continue promoting activities to disseminate and share AI R&D Guidelines and AI utilization guidelines.

B. Review of The Draft AI R&D Guidelines for International Discussions and AI Utilization Guidelines

As mentioned above, initiatives presented through the hearings include those considered to be excellent initiatives responding to the principles of the AI R&D Guidelines and the AI Utilization Guidelines and particularly noteworthy initiatives for "Safe, Secure, and Trustworthy Implementation of AI in Society" beyond the scope of the two Guidelines. As mentioned in Chapter 1, there are various initiatives regarding AI ethics and governance in foreign countries. In particular, it is necessary to

[87] For example, regarding "Ensuring explainability" of the "Principle of transparency" the AI Utilization Guidelines state:" AI service providers and business users are expected to ensure the explainability of the judgment results of AI for the purpose of ensuring the trust of users and to present evidence of AI behavior." "Detailed Explanation on Key Points Concerning AI Utilization Principles" attached to the Guidelines states: With consideration of the needs and opinions of consumer users, clarify parts in which an explanation is lacking, and collaborate with developers to find out what kind of explanation is necessary." Furthermore, at the Promotion Council, there was an opinion to ask for consideration to be given to privacy protection and security from users' point of view when using AI.

study how to respond to the "Proposal for a Regulation Laying down harmonized rules on artificial intelligence" published by the European Commission. In order to appropriately respond to the situation, it is important for the Promotion Council to review the AI R&D Guidelines and the AI Utilization Guidelines, and consider reviewing their positioning, scope and principles as necessary.[88]

As mentioned in the preceding chapter, some approaches to personal information and privacy in COVID-19 countermeasures using AI vary depending on the country/region. It is important for the Promotion Council to examine the guidelines to find the appropriate balance between improvement/extension of public health and privacy protection

The purpose of both guidelines includes increasing the benefits of AI, and mitigating the risks through the sound progress of AI networks. Furthermore, the AI R&D Guidelines state: "To ensure an appropriate balance between the benefits and risks of AI networks, so as to: (a) promote the benefits from AI networks through innovative and open R&D activities and fair competition; and (b) mitigate the risk that AI systems might infringe rights or interests, while fully respecting the value of the democratic society such as academic freedom and freedom of expression" in the Basic Philosophies. The AI Utilization Guidelines state: respect the diversity of people utilizing AI (users) and include people with diverse backgrounds, values, and ideas" in the Basic Philosophies. Considering these statements, when considering review of the guidelines, it is necessary to pay attention to "securing of a competitive ecosystem" and "protection of benefits of users."

(iii) Following and disseminating information on domestic and international trends and international discussions

As mentioned in Chapter 1, various efforts regarding AI ethics and governance are made in Japan and abroad and there are active international discussions. When conducting a review regarding AI, it is important to consider domestic and international trends and international discussions. The Promotion Council will continue to follow these trends.

In addition to following trends, it is also important to disseminate information from Japan to lead and contribute to international discussions. It is important to disseminate information of case studies of the initiatives taken by business operators, etc. as compiled in the Report in international discussion forums, including multilateral forums, such as the OECD and GPAI, as well as bilateral policy dialogues, while taking into consideration Japan's industrial structure where Business to Business transactions account for a considerable part.

As mentioned in Chapter 1, in the "Proposal for a Regulation Laying down harmonized rules on artificial intelligence" published by the European Commission in April 2021, providers and users in third countries that launch AI systems in the EU and provide AI system deliverables are also subject to regulations on high-risk AI. For this reason, when the proposal is adopted and applied, it will exert a potent influence in the world, including Japan, as in the case of the General Data Protection Regulation (GDPR).

It is important for the Promotion Council to conduct research on the proposal, taking into account trends in international discussions.

[88] Both guidelines state: "constantly review the Guidelines through continuous international discussions, and flexibly revise them as necessary" in the respective "Basic Philosophies"

(2) AI Development and Utilization

The hearings showed that many business operators were advancing initiatives for AI development/utilization in various fields including COVID-19 countermeasures, medical/health care and support for the elderly and people with disabilities. This is considered as showing the usefulness of AI widely in many fields. It is expected that new technologies will be developed, new services will be provided and the convenience of existing services will be improved based on the case studies.

In light of the above, it is important to disseminate and share case studies of the initiatives taken by each business operator, etc. The Promotion Council and MIC will promote activities to disseminate and share these case studies in cooperation with external stakeholders.

It is also important for Japan as a developed country which has new problems to demonstrate to the world that AI development and utilization will contribute to solving social challenges. It is important to disseminate information on the initiatives of individual business operators, etc. as compiled in the report, in international discussions.

(3) Human Resource Development

The hearings showed that many business operators were promoting initiatives for human resource development with ingenuity.

Nevertheless, shortage of AI human resources is a common challenge around the world and human resource development is a pressing issue also in Japan. It is important for AI developers and users to continue to promote initiatives for human resource development, referring to the cases of business operators as compiled in this report. While development of technically excellent AI human resources is hoped for, there are also initiatives to improve AI literacy. With this regard, we also hope for the development of human resources who can contribute to identification of and response to ethical, legal and social issues (ELSI) associated with AI development and utilization.

Cooperation with external educational and research institutions is believed to deepen the initiatives of AI developers and users, while at the same time contributing to raising the level of society as a whole. It is hoped that AI developers and users will promote initiatives in collaboration with external educational and research institutions, etc. rather than doing this independently.[89]

It is also important to implement human resource development initiatives not only for the private sector, but also for employees of ministries and agencies as well as local governments.[90]

4. Overview of the initiatives by business operators, etc.

This section presents an overview of the initiatives taken by business operators and an overview of presentations and opinion exchange at the hearings. See Attachment 3 that compiles the initiatives by business operators, etc. with more details including individual activities. (Presentation materials are available on the MIC website.)[91]

Note that the expression of the description is based on the presentation and opinion exchanges of the actual hearings.

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[89] Regarding ELSI, there are initiatives to promote industry-academia collaboration. For example, Osaka University established the “Research Center on Ethical, Legal and Social Issues” (ELSI Center) in April 2020, and Chuo University established its “ELSI Center” in April 2021.

[90] AI Strategy 2021 (Follow-up to “AI Strategy 2019”) also provides:” in the light of the progress of AI utilization in government agencies, we should work on implementation of AI-related education for administrative officers.”

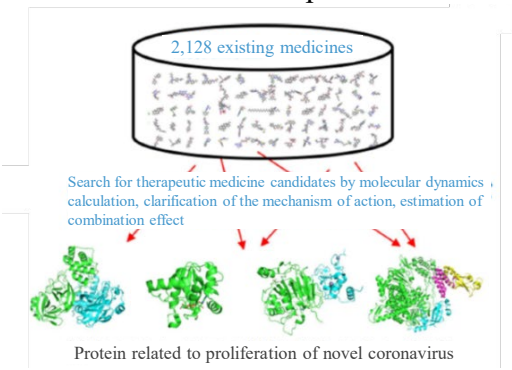
[91] See Note 74 above.

Prof. Yasushi Okuno (Kyoto University Graduate School): Challenge of developing COVID-19 treatments using the supercomputer “Fugaku” and AI

Summary of the key initiatives regarding AI development/utilization

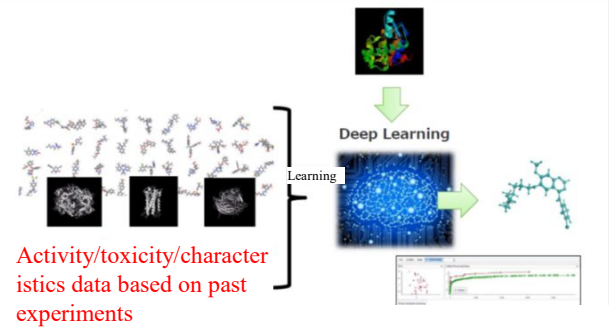
Initiative	Summary
Identification of therapeutic medication candidates against novel coronavirus	By molecular simulation using Fugaku, searching for candidates of therapeutic medication that acts on target proteins related to proliferation of novel coronavirus among existing medicine
Drug design	When the name of a protein is entered, AI that has learned past experiment data automatically designs compounds that bond with the protein.
Changes in the gene network depending on the amount of novel coronavirus in the body	Analyzing changes in the gene network of infected patients showing only minor symptoms and those with serious symptoms in order to identify factors of aggravation.
Establishment of a consortium and AI development	Kyoto University, RIKEN, National Institutes of Biomedical Innovation, Health and Nutrition, pharmaceutical companies and IT companies established the Life Intelligence Consortium (LINC) to promote development of drug discovery AI by the entire industry. The consortium is developing about 30 types of AI covering all drug development processes and medical care
Efficiency improvement and sophistication of medical care by digitalization	Reducing the number of patient visits to hospitals, reducing the burden on medical sites, economizing the labor force and suppressing unnecessary treatments through digitalization (using IT, AI, etc.)

Identification of therapeutic medication candidates against novel coronavirus



By molecular simulation (molecular dynamics calculation) using Fugaku, we search for therapeutic medication candidates that act on target protein related to proliferation of novel coronavirus among 2,128 existing medicines that are used in medical practice.

Artificial intelligence that designs drugs



Just enter protein names, and AI that has learned past experiment data automatically designs compounds that bond with the protein.

■ Overview of the presentations and opinion exchanges at the hearings, etc.

○ We searched for a drug for COVID 19 using the supercomputer Fugaku Specifically, we searched for therapeutic drug candidates to suppress proteins related to COVID 19 proliferation from about 2,000 existing drugs by molecular dynamics calculation, which is a type of molecular simulation.

○ Simulating moving protein while clearly showing water involves very high calculation cost and therefore requires a supercomputer. Simulations of moving protein that is made to hold drugs in water are difficult calculations even for supercomputers. Because machine power increased a hundredfold from "Kei" to "Fugaku," we can carry out computer experiments of several thousands of chemical compounds.

○ In ordinary drug discovery experiments, we culture cells, sprinkle drugs and see whether the virus stops growing, but the process takes as long as several months. However, computers can conduct simulations in a short period of time. In this simulation of therapeutic drugs against novel coronavirus, 2,128 kinds of drug candidates were used and ranked. When appropriately combined, some of the top-ranking candidates in the simulation using Fugaku are also highly evaluated abroad, which shows that calculation of Fugaku is not haphazard.

The simulation that would normally take several months was calculated by Fugaku in 10 days. In April, when the simulation was conducted, Fugaku was still in the state before tune-up of applications. Now after the tune-up, simulation of 2,000 kinds of drugs that formerly took 10 days now can be completed in 2 days.

○ Drug discovery takes many years and involves high costs. The process starts from the search for drugs, and through optimization, animal tests, and clinical trial on humans, the drug is finally used as therapeutic medicine in medical practice. However, existing medicines can be used for human beings by skipping the middle processes because it is known that there is no toxicity or side reaction problem.

○ In conventional drug discovery, once a hit compound is found, experiments are conducted to check whether the compound avoids toxicity, has medicinal effects, has side reactions, etc. The synthesis is repeated many times until the final product is non-toxic, highly absorbable, and metabolically stable. The long period of time and the high cost are the challenges in drug discovery; therefore, efforts are underway to use AI to mitigate these issues and to design compounds.

○ Now we are becoming capable, after a fashion, to make AI find chemical compounds that bond with a certain protein or think of compounds that do not have toxicity. With this capability, we would not need simulations by supercomputers and we would be able to design chemical compounds, but this is difficult in the case of COVID-19. In the case of COVID-19, there are almost no past cases; it is not possible to create AI based on past cases. Then, do we need experiments as before? We believe that one strategy would be to make simulations using "Fugaku" and skip experimenting. We are conducting research with good combinations in mind while conducting simulations using AI.

○ Benefits of medical AI include reduction of the number of patient visits to hospitals and proposal of optimal treatments for individuals, which can suppress unnecessary treatments. It is also said that it will reduce the burden on medical sites and economize the labor force.

○ Improvement of the efficiency and sophistication of medical care using AI are key to "life with corona" and said to be important for delivering medical care safely under COVID-19 or for preventing medical care breakdown. While digitalization in medical care is emphasized, we think that data are also essential for COVID-19 countermeasures.

○ Not only in drug discovery but also in medical practice, we think it is important to produce convincing results for users when we extract prediction factors by using explainable AI technology. Because whether explanation can persuade or not depends on the experience of the individuals, it is considered to be necessary to establish benchmarks and guidelines and only require that their standards be satisfied.

Fujitsu Laboratories: Fujitsu's AI Research Activities in the New Normal

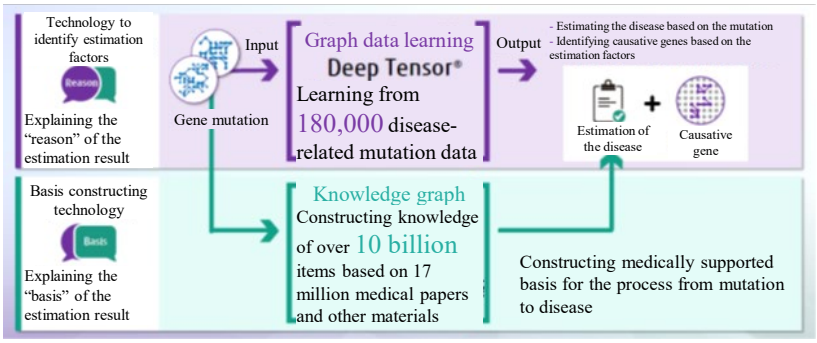
Summary of the key initiatives regarding AI development/utilization

Initiative		Summary
AI that can solve social challenges		
	Wide Learning	Producing all combinations of data items as hypotheses even from a small number of data and presenting hypotheses that are comprehensible for humans
	Optimization: Digital Annealer	The quantum-inspired technology derives optimum combinations rapidly and with a high precision
	Reduction of introduction period: Actlyzer	Reducing introduction period by combining various learnt models without individual preparation of learning data or PoC
	Automation of AI operations: High Durability Learning	Automatically monitoring and repairing AI accuracy that deteriorates with changes in data during system operation
	AI× simulation	For real-time prediction of and countermeasures against natural disasters that have not been experienced before, reproducing physical simulation and people flow simulation by machine learning and optimizing inundation prediction of large-scale tsunami and evacuation routes
Trustworthy AI to be implemented in society		
	Explainable AI	Integrating graph data learning and graph expression of knowledge to visualize the ground of AI output
	AI security	Detecting AI-deceiving cyber-attacks by automatically generating training data based on the characteristics of deception attacks and by employing ensemble learning using models for each characteristic of multiple attacks
	Facial expression recognition	Reading facial expressions to recognize mental states including concentration and conviction which are difficult to recognize without face-to-face meeting
	Image diagnosis support	Supporting diagnosis by sampling slices that include the lung region from chest CT images, extracting the lung area and classifying shadow patterns

Summary of the key initiatives regarding AI ethics/governance

Category	Summary
Guidelines and principles	“Fujitsu Group AI Commitment” was formulated in March 2019.
Organization and structure	External committee on AI ethics was set up and was held with the aim of feeding back objective opinions and ideas to the AI Ethics Guidelines
Human resource development	Implementing e-learning on AI ethics for all employees

Explaining the basis by using knowledge graph



■ Overview of the presentations/opinion exchange at the hearings

○ With regard to AI ethics, Fujitsu Laboratories Ltd. works in collaboration with various departments in Fujitsu, such as business units, legal affairs, and human resources. Fujitsu Laboratories Ltd. comprises not only computer science researchers but also social science researchers working on psychology, fieldwork, and cognitive science. It is important to include the perspectives of psychology and cognitive science.

○ It is important to create a forum for global discussions on AI ethics and create a process of opinion exchange.

○ We are conducting AI research based on the three points: (1) AI that can solve social challenges (AI that not only recognizes and predicts but also contributes to solution of social challenges through optimization of decision making and discovery); (2) AI that can respond to continuous changes in society (AI beyond leaning from the past based on machine learning, AI that can respond to continuous changes in society) and; (3) Trustworthy AI to be implemented in society (AI research considering social risks in implementation of AI, which include the issue of black box, AI security and AI ethics).

○It is a big challenge that collecting data for AI learning and the learning itself take time. In order to address the challenge, we will create basic action recognition based on basic human actions to enable recognition of various actions by simple customization. As a COVID-19 countermeasure, for example, simple customization of hand-washing action recognition will enable introduction in a short period of time.

○ AI that was usable sometimes becomes unusable due to changes in data characteristics after starting service provision. (In the case of credit risk assessment, for example, 91% accuracy at the time of learning deteriorates to 69% in one year if nothing is done.) How to operate AI is a big challenge. To address this challenge, we can use technologies of "automatic monitoring of accuracy degradation" and "automatic restoration of accuracy." (In the case of credit risk assessment, degradation prediction error is 3% and accuracy can be increased from 69% to 89% through automatic restoration.)

○ With regard to explainable AI, the concept of AI that humans can trust, understand, and manage is important, and it is conceivable to respond by explaining the rationale by using a knowledge graph. For example, in the medical example, a knowledge graph can be created from the medical papers and knowledge databases. An explainable AI can identify whether it is possible to create medical and pharmaceutical grounds is input by connecting past medical papers and knowledge databases on the knowledge graph.

○ With regard to AI security, with the spread of AI, attacks against AI (such as deceiving AI and stealing AI information) and threats using AI (such as deceiving with AI) are emerged. For example, Fujitsu Laboratories Ltd. has developed a technology to detect spoofed attacks (that trick AI) with high accuracy by automatically creating training data and using models for each of the characteristics of multiple attacks.

○ Lifecycle is very important in quality management, which is not limited to operation. It is a very important research theme for venders providing AI to properly define quality and implement lifecycle quality

management in addition to the quality during test and development stages.

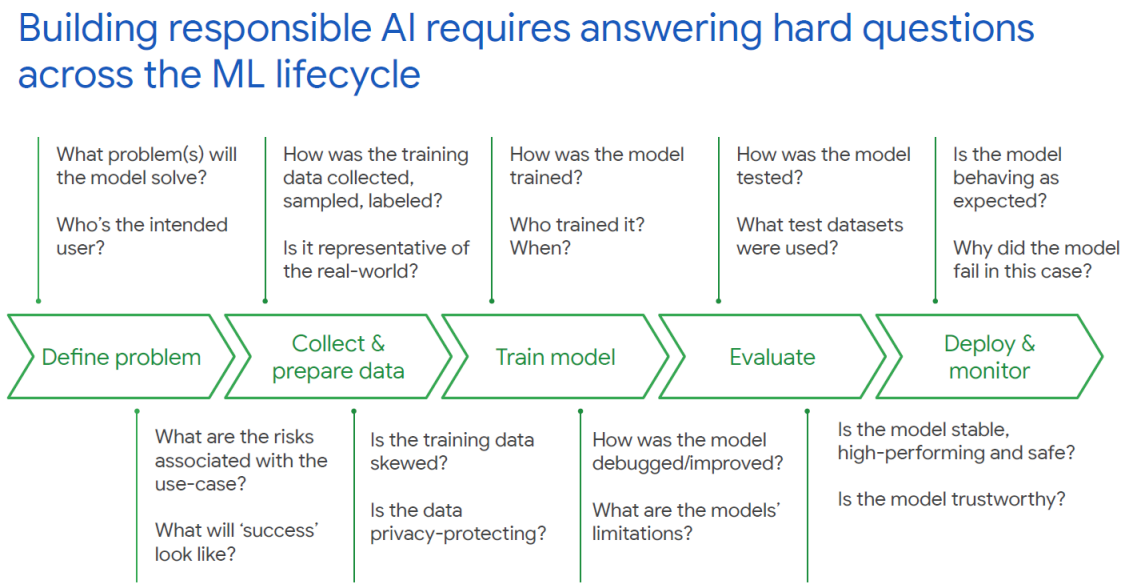
○ We are implementing a program where all Fujitsu employees can enroll in e-learning on AI ethics.

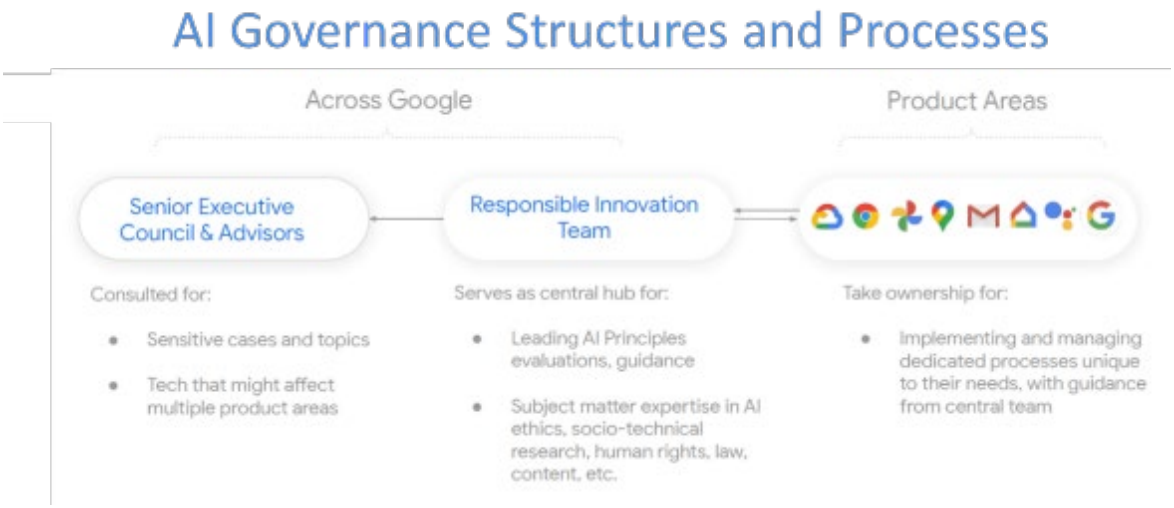
○ For economic activities and R&D to support life in the New Normal, we need survey and classification of specific challenges not only on the seeds side but also on the user side. Not only research of seeds but also fitting with the needs side is also important.

Google: Putting our AI principles into practice

Summary of the key initiatives regarding AI ethics/governance

Category	Summary
Guidelines and principles	For development of AI trusted by users, applications to be implemented were separated from those not to be pursued and "Basic Policy of AI Utilization" was formulated in June 2018
Organization and structure	Constructing a multifaceted structure to implement review from ethical, technical and other points of view in the light of the AI principles
Development review	Developing and introducing tools, technologies and infrastructure for incorporation of AI ethics in our work, while at the same time developing a review process.
Transparency and accountability	Developing a technology to ensure transparency of models
Cooperation and collaboration with external parties	Through collaboration with communities outside of the company, we try to understand what users and society are demanding and reflect this in our development, while contributing to formation of international standards on AI.
Human resource development	In addition to education for all employees, we provide education for people outside the company who wish to learn responsible AI.





■ Overview of the presentations/opinion exchange at the hearings

○ It is important not only to publish AI principles but also to be able to interpret and practice the principles. The aim of AI principles and the governance based on them is to earn and maintain the trust of users.

○ In order to create trustworthy AI, developers themselves need to be trustworthy and conduct development through trustworthy processes.

○ It is very important to confirm that the company's products are in accordance with the company philosophy, actively undertake evaluation and improvement and pay careful attention to the content of one's own publication.

○ In the practice of the AI principles it is important to learn from internal and external experts through honest and continued dialogs with users, government officials and other stakeholders.

○ We work with externa experts, as well as scholars and minorities, and listen to their perspective regarding AI principles, their practices, and reliable products. It is very important to collaborate with the outside world to understand what users and society want, and to incorporate that into our daily development.

○ Introduction of the AI principles start from having all employee understand how the principles apply to their job.

○ The Responsible Innovation team is formulating various rules and policies for trust in conformance with AI principles. In addition, the company provides guidance to teams on how to emphasize AI principles and develop educational materials to help all employees understand and deal with the complexities of AI principles and the problems they address. In addition, it serves as a hub of specialized knowledge on a variety of topics, providing information internally on cases such as AI ethics, social risk research, and human rights.

○ The Central Review Team identifies the AI principles to be applied, and then the review team asks appropriate internal product, ethics, fairness, security, privacy, and other experts to gather specific guidance. Then, the reviewer considers the seriousness of the benefit s and damages, the likelihood that a benefit or damage will occur, and asks questions and conducts checks that reflect AI principles. Subsequently, the product research team conducts a technical evaluation according to the technology (for example, examining fairness for new models of machine learning), and, if necessary, consults with an external expert and makes the necessary adjustments to the product.

○ When a difficult ethical problem has occurred, a higher council comprising executives conducts final review and decides how to proceed. In other cases, the Central Responsible Innovation Team makes the final decision, catalogs, and communicates the decision to relevant people. These decisions are accumulated as

precedents.

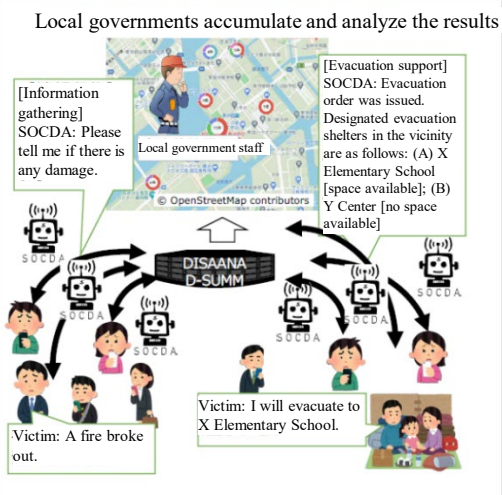
- ○ It is important thing to bear in mind that this process requires regular repetition. Because we don't have the answer to everything, we must learn from individual cases and gradually build a system. What we learn in basic research and product development will be used for design of the entire process and development of tools to help subsequent research, product improvement and realization of AI principles.
- ○ The diversity of human resources is emphasized, including the fact that the people who provide input are very diverse. This diversity, which includes men and women, is characterized by the gathering of scholars from different cultures.
- ○ Our in-company training is implemented in combination of training courses and online materials for self-study, which can be used by all employees.
- ○ We include an educational program on responsible practice in basic training of various roles such as product manager and software engineer. With regard to technology and ethics, we seriously study fairness of machine learning, human-centered design and other topics based on wide-ranging discussions.

NICT: Large-scale natural language processing technology aimed at solving social issues

Summary of the key initiatives regarding AI development/utilization

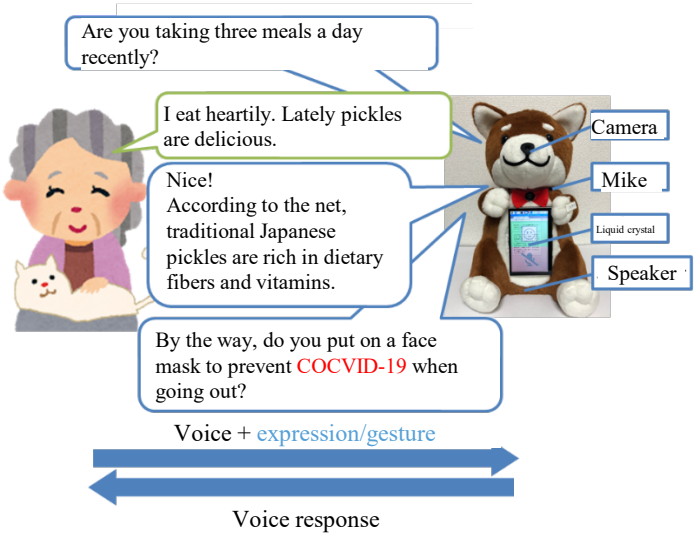
Initiative	Summary
Large-scale web information analysis system	Answering various questions and generating hypotheses based on 4 billion web pages
Disaster SNS information analysis system	Answering disaster-related questions by using Twitter information. The system can summarize damage when an area is designated.
Disaster prevention chatbot	AI interacts with individual disaster victims via LINE, collects damage information and provides evacuation information
Next-generation voice interaction system	System of light conversation with an extensive knowledge database that interacts with people while providing knowledge gathered from 4 billion web pages.
Multimodal voice interaction system	The system grasps health conditions and lifestyle of the elderly through image and voice recognition, while at the same time solving their lack of communication by light conversation with AI.

Disaster prevention chatbot (SOCDA)



AI instead of humans automatically interacts with a large number of disaster victims via LINE, collects damage information and provides evacuation information

Multimodal voice interaction system (MICSUS)



Multimodal voice interaction system equipped with AI that can read facial expressions and gestures of the elderly in addition to voice

■ Overview of the presentations/opinion exchange at the hearings

○ Disaster prevention chatbot SOCDA is a system where AI instead of humans automatically interacts with a large number of disaster victims via LINE, collects and analyzes damage information and provides evacuation support. The system is expected to collect information through interaction with individual victims or serve as a guide to an appropriate shelter. When realized, this is considered to be digital transformation in disaster prevention/mitigation.

○ Multimodal voice interaction system (MICSUS) aims to reduce the burden on care managers who are in short supply by leaving a part of nursing care monitoring to AI. Furthermore, as a COVID-19 countermeasure, interposition of the interaction system (MICSUS) can prevent 3C's (closed spaces, crowded spaces and close-contact settings) and reduce infection risk.

○ Lack of communication is pointed out as a factor to worsen health conditions of the elderly. Many elderly people want conversation with people and seek communication. MICSUS is an attempt to solve the problem through light conversation with AI. The system equipped with a camera can read emotions, etc. from facial expressions and gestures of the elderly in addition to their voice. It is expected that introduction of AI into care monitoring will enhance the function to check health conditions and improve the quality of care.

Care managers say it is nice that they do not need to enter the data of dialog results. According to them, entering health conditions into a database on the computer after one or two hours of dialog was time-consuming. Because voice data directly flow into the data base through MICSUS, we think that it will reduce burden on care managers and contribute to digital transformation.

○ With regard to natural language processing, it is believed that large-scale language models will provide performance equal to or better than humans in straight question answering and information extraction except for text generation. Unsolved problems include inability to produce a large amount of appropriate learning data, which shows an insufficient performance level. In the case of reasoning, for example, because of a large number of information combinations, it is not easy to create information data and comprehensive learning data. This is a future research issue.

○ It is difficult to judge whether AI should be allowed to recommend specific products or services when it speaks to people. This may depend on whether or not the intentions of a private company are included. Technically, we think this is possible only when boundaries are drawn.

○ Claiming "explainable AI" when the technical level is insufficient may involve a big risk: namely, AI may

automatically generate convincing justifications as such a regarding inappropriate judgment, and it may spread as an appropriate judgment. Viewed from the opposite side, currently we don't have an answer to the question of: 'how to secure validity of explanation or justification presented by Explainable AI?'. If Explainable AI presented the validity of explanation and justification presented by Explainable AI, we would fall into infinite regress.

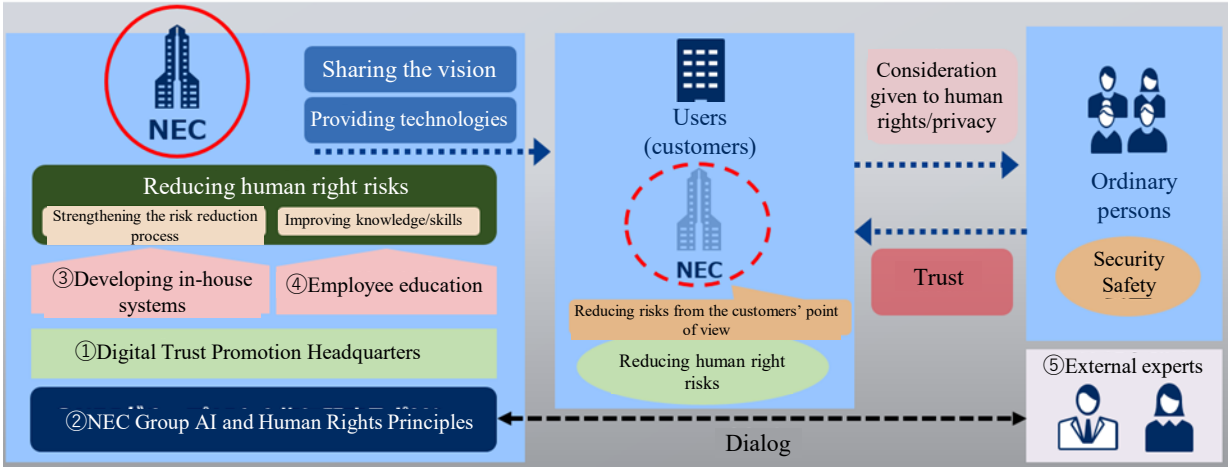
- Fake news has become a problem and activities called fact check have appeared as a countermeasure. However, when searching with key words "fact check" and "bias" we find many results that question its trustworthiness, which include "fact check itself is biased" and "unreliable." In this situation, it is difficult to judge what is right.

NEC: Toward a safe, secure, and trustworthy implementation of AI in society

Summary of the key initiatives regarding AI ethics/governance

Category	Summary
Guidelines and principles	In order to prevent and solve human right problems that can arise through AI utilization, we established "NEC Group AI and Human Rights Principles" in April 2019.
Organization and structure	We established the “Digital Trust Promotion Headquarters” to decide company-wide policy on AI, biometric authentication and data distribution in order to reduce human right risks. In addition, we held the “Digital Trust Advisory Board” to check the correctness of the activities in a multifaceted way by incorporating diverse opinions of external experts.
Development review	We have prepared and implemented a checklist incorporating check items to reduce human rights and privacy risks in our development and operation processes.
Privacy	Realizing privacy protection by secure computation technology and safe and secure data distribution using blockchain
Transparency and accountability	Developing white-box-type AI that can explain the rules discovered by AI, and reasoning AI that can reason by learning human knowledge and knowhow and logically explain the basis.
Appropriate use	Proposing measures to prevent human right problems by obtaining prior consent of the face recognition from the person, for example
Cooperation and collaboration with external parties	Promoting industry-academia cooperation including the conclusion of “the NEC/University of Tokyo Strategic Partnership Agreement for Future AI Research and Education”
Human resource development	One-stop provision of the functions necessary for AI human resource development for the outside world Implementing e-learning for all employees and individual study meetings for people involved in biometric authentication

Initiatives based on the NEC Group AI and Human Rights Principles



■ Overview of the presentations/opinion exchanges at the hearings

○ NEC established "NEC Group AI and Human Rights Principles" in April 2019, while at the same time developing an internal system and implementing employee education. Since we need to listen to various opinions on these issues, we also organize dialogues with external experts. Based on this, it is important to create something to earn trust while also considering technology in terms of human rights and privacy; we are therefore engaging in such activities. activities.

○ It is important that data be distributed in a safe and secure manner, and secure calculation techniques are used to ensure that calculations are made in a manner that does not identify individuals. For example, if the data held by a medical institution are encrypted, distributed across servers, and processed using secure calculations, the data can be retained individually. However, as the volume of data used increases, the overall performance also improves, and a new value can be created. In addition, research and development are being conducted on blockchain such that it conveys information reliably.

○ Challenge in face recognition is to drastically raise the technology level and increase its resistance to the usage environment. When providing solutions, it is important to have users understand the solutions. For example, services in airports take the form of opt-in and can be used only with consent for face recognition. Our approach is that the number of users will increase when its advantages including shorter procedure time are known. People who favor the conventional ways can choose the conventional process.

○ There is a problem that reflectance to lighting varies depending on the skin color. Based on such recognition, we are studying how well technologies can address the problem.

○ We use terms: black box and white box. Typical example of a black box is deep learning: when we want to radically improve factory operation efficiency, if operation efficiency is improved as a result, we may say this AI is good even when we don't know the content.

With white box, on the other hand, human beings make decisions based on the suggestions made by AI. Very simply put, this is a classification device, a sophisticated system to classify various patterns to produce results. In the case of demand forecast, AI presents that a 'demand like this' will expand under a 'condition like this'.

○ In addition to the use of AI itself, our R&D approach is to improve the process while combining simulators and, in some cases, existing operation manuals. For example, when a chemical plant was launched, we made AI propose optimum procedures while incorporating simulators and manual operations, and skilled operators evaluated the validity of the proposal before proceeding with the launch. In this way, we could reduce the time for launch. Our approach of implementation is to combine technologies most suitable for the task to be tackled.

○ For safe and secure town development, we conducted a demonstration in private land and installed smart streetlights. We formulated a guideline for this demonstration based on guidelines for utilization of camera images[92], while taking into consideration the Personal Information Protection Act and expert opinions. At the same time, we made the content of the guideline known to the shopping malls and relevant people beforehand and made announcements during the experiment. Introduction of new things involves various risks, but it is important to realize them while ensuring maximum risk management.

○ The company provides AI literacy education for external users and also creates and provides various types of programs for university students, working adults, and researchers.

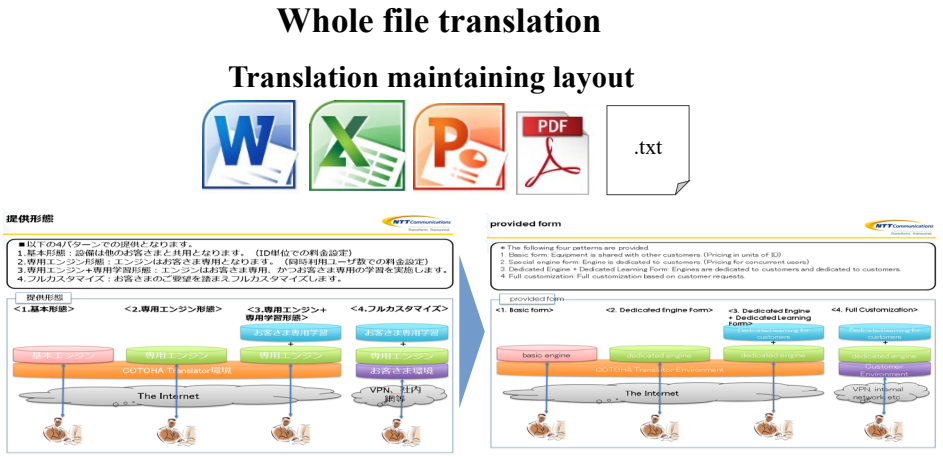
[92] "Guidebook for Camera Image Utilization version 2.0" (March 2018) compiled by the IoT Promotion Consortium, MIC and METI.

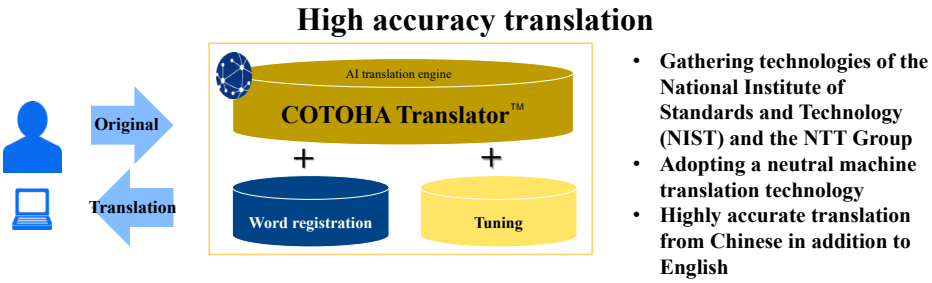
○ Regarding in-company training, particularly because we use biometrics, we have all employees learn privacy and human right risks periodically through an e-learning program to ensure their recognition. Because the knowledge cannot be learned in one session, all employees learn once a year on a continuing basis. All employees need to pass tests to complete learning. We gather data of the training and obtain information by means of questionnaires and will monitor the change in knowledge level based on their analysis.

NTT Communications: Smart World realized by communication AI

Summary of the key initiatives regarding AI development/utilization

Initiative		Summary
Image		
	Detecting and tracking people by monitor camera	Judging the congestion level in the facility and displaying the result real-time Detecting people not wearing a face mask at the entrance and displaying a message to wear a mask.
Text		
	Highly accurate translation of sentences	Translating with a high accuracy of the level over TOEIC 960 while ensuring security by encryption processing and maintaining the file layout to contribute to working style reform through reduction in translation time
	Understanding sentences and searching for an answer	AI answers questions without FAQ with reference to a manual.
Voice		
	Low-cost and easy creation of FAQ	Japanese operator and AI handle 14 languages
	Automatic generation of minutes	Real-time transcription of speech during meeting into text
	Automated voice interaction	Responding to toll-free number inquiries by using voice recognition, voice synthesis and meaning/intention interpretation
AI technology		
	Voice recording during operation by using API	Voice recording during operation and automatic extraction of points from the record Considering or implementing demonstration in rehabilitation, construction and cram school fields
Everywhere vision		Contributing to realization of Smart World by making AI service instantly available in existing services (data network, telephone/videotelephone, application, managed and cloud services)





■ Overview of the presentations/opinion exchange at the hearings

○ Social roles of communication AI in the New Normal era include safety and sustainable development. Regarding safety, communication by AI talking with customers is free of COVID-19 risk. With regard to sustainable development, we think that complementation/substitution of human operation and business continuation without human work will make a big contribution.

○ We define communication AI as AI that connects people to people and people to things in all types of communications including language, voice, action, visual, emotion and thinking, to make people happy. We are providing services under this concept.

○ Regarding our translation service, we translate the whole file as it is including Word, Excel, PDF and PowerPoint pages. The number of characters tends to increase when text is translated into English but we pursue adjustment in order to maintain layout and decoration as well.

○ Because security influences data reliability, we focus our efforts on security. In our translation service, for example, we make clients' translation files invisible, encrypt them and enable closed network connection. Files are automatically deleted, and translation logs are removed. Furthermore, we don't use client data for AI learning, and we make separate investments for AI learning. We expend all possible means to ensure security, which include file virus scan and IP address authentication.

○ In the pharmaceutical industry, application of new drugs involves a lot of translation work, which are difficult translations handling technical terms of chemistry and pharmacy. With the aim of providing translation equal to professional translators, we collected confidential information jointly with customers in order to improve accuracy.

○ We are tackling the concept in order to incorporate AI in our current data network, telephone/videotelephone, application, managed and cloud services and make AI ready to use.

We are working to provide services integral with a network: data network service includes translation, knowledge facilitation in meetings, help desk, minutes generation and monitoring of building interiors, and telephone service includes operators to act as sales agent in addition to use of toll-free telephone lines. We want to include chatbot in our application services as an initial setup.

○ This is a case study of the introduction of chatbots to handle inquiries of local governments. The time required to respond to inquiries about COVID-19 has been reduced, allowing governments to focus on other types of work or to respond 24 hours a day. Chatbots can also provide a service that translates inquiries from foreigners who cannot speak Japanese; the translation is provided while the caller is speaking. When it is not possible to interact via chatbot, an operator will respond; however, if the operator can only speak Japanese, the interaction can be handled via chatbot.

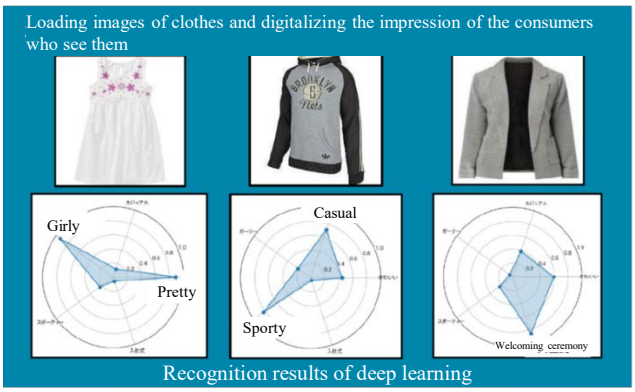
○ We detect moving routes of infected people, feverish people, congestion level and mask wearing. For example, by installing cameras in offices, we can restrict admission based on the judgement of the congestion level in the facility, or detect people not wearing a mask at the entrance and display a message to wear a mask.

Prof. Hidenori Kawamura (Hokkaido University Graduate School): Research case study and start-up at the Laboratory of Harmonic Systems Engineering, Hokkaido University

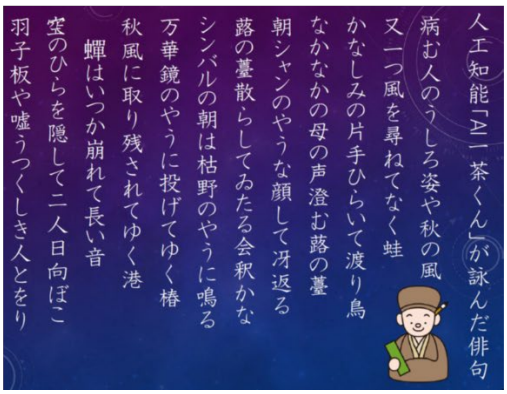
Summary of the key initiatives regarding AI development/utilization

Initiative	Summary
Automated driving of RC cars that give way to each other based on the Deep Q Network	Realizing smooth driving through "giving way" by recognizing the action of other vehicles at road junctions during automated driving
Study on the mechanism and group control of balloon robots	Study of group control of balloon robots holding helium gas
Understanding of fashion images by using deep learning	Analyzing purchase trends by tagging consumers' subjective and functional characteristics regarding fashion to images
Development of automatic tag generation algorism in eating/drinking category	Contributing to quality improvement of search results by automatic tag generation of eating/drinking images
Recognition of snow cover state and road heating control based on a convolutional neural network	Grasping the snow cover state by image recognition and efficiently controlling road heating
Automated discrimination of acoustic data of set net fishing ground and fish finder	Distinguishing fish species by image recognition of acoustic data of fish finder
Defect inspection of industrial products by using deep learning	For industrial products for which it is difficult to obtain images of a large variety of defective products, defect inspection is conducted by using images of conforming articles alone
Recognition of driving state based on indoor images	Detecting abnormal behaviors of the driver based on images of inside of the car
Analysis of circumstances in bus interiors with a camera in the bus using AI technology	Real-time detection of congestion status in a bus and of careless behavior such as standing without holding railing
Development of a system for shift optimization by chatbot using AI	To respond to sudden absence in call centers, etc. the system realizes efficient replacement by first requesting attendance of employees who are likely to be able to attend.
Automated creation of articles predicting bicycle race results	Creating bicycle race prediction articles to enhance the attractiveness of the content
Automated creation of product introduction essays for EC site	Creating product introduction essays for EC sites
Automated creation of haiku by AI Application to satirical haiku by AI	Creating haiku suitable to the image Creating satirical haiku suitable to the given theme
Ventures certified by Hokkaido University	
AWL Inc.	Proposing store operations in the era of coexisting with the novel coronavirus
Chowa Giken Corporation	Proposing solutions to individual difficult tasks that cannot be solved by general purpose cloud AI

Understanding of fashion images



Automated creation of haiku by AI



■ Overview of the presentations/opinion exchange at the hearings

○ Feature of our AI research is, in addition to the technical aspects of deep learning and machine learning, inclusion of the viewpoint of social implementation, namely, how to use these technologies for society. We are characterized by the fact that we are conducting extensive joint research with companies in order to perform research not only from a laboratory but also from an outside perspective in response to the issues that companies are facing and the data that only companies possess. We have collaborated with companies of various sizes, ranging from large corporations to venture companies.

○ About management of joint research by universities and companies

- Because AI is a technology wanted by society, we carry out projects keeping contact points with society in mind, by utilizing the involvement of external participants rather than using a closed group of students and teachers, and by treating students as independent adults.
- In order to proceed to higher education, students need to produce results such as conference and paper presentations. For this reason, we divide projects and clearly declare to the companies that this is research of the university conducted as part of its education and research. On the other hand, teachers also consider results on the company side and ensure management with proper balance of both sides.

○ Regarding the case of fashion images, the system can visualize the components of merchandise that sold well last month, and feature quantities of the new merchandise, for example. The research is based on an idea that we may be able to bring a very scientific and industrial process to the fashion industry that has allowed only individualistic approaches.

○ With regard to the road heating case, we could demonstrate that the device could maintain performance while reducing gas consumption by about 40 to 50% compared with the conventional sensors. We think that its practical application will have a considerable ecological impact.

○ We set up a venture company to conduct AI R&D that is difficult for an ordinary company in order to contribute to difficult AI development in society with our academic skills. We are conducting AI development employing doctor-level researchers by increased targeting on AI that is more individual than generic, highly unique and impossible to attain without advanced technologies.

○ For example, we are conducting joint research with a manufacturer of food processing machines to recognize the position of fish bones in images and remove the bones by using robots. Correct recognition is difficult for generic AI and we need AI specialized for this purpose. We think that there are areas that require very edgy and niche but sophisticated AI, and perfectly fit the manufacturing industry of Japan. Tackling sharp points in edgy areas is a very important tactic for Japan to survive.

○ Before starting technology development of the AI camera solution, we conducted very deep discussions with

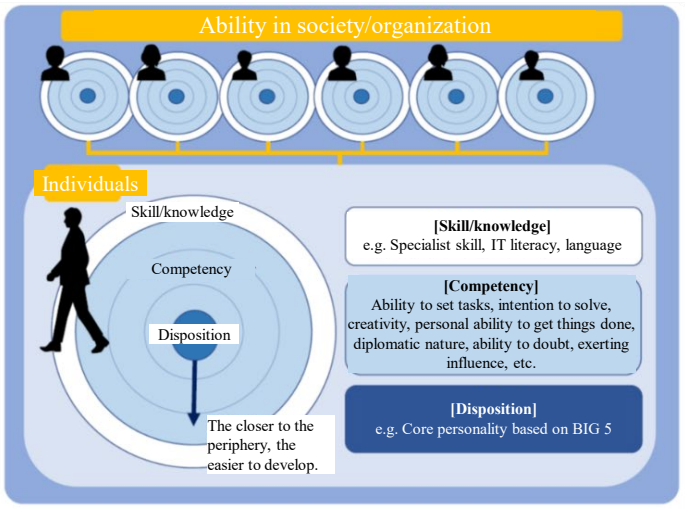
the president of the company introducing the solution on cautions when introducing the solution in actual stores. For the purpose of shop lifting prevention, for example, there is an approach to improve precision but people on the floor do not necessarily desire correct recognition. When a suspicious person is found, a staff is sent to ask “can I help you?” In this way, persons who need help will be helped, while truly suspicious persons will see that they are marked, which may work as deterrent. It is important that accuracy is not always the most important factor. Another challenge was cost: the number of cameras per store (several dozen) x number of stores (200) x 12 months. This is considerable annual cost. In order to reduce the cost, we decided to use microcomputers on the side of the network terminals and had great difficulty with the construction.

Institution for a Global Society: Protection of personal information that accelerates data-based education with fair evaluation by AI. Human resources development and an education platform

Summary of the key initiatives regarding AI development/utilization

Initiative	Summary
Education evaluation system	Accurate visualization and quantification of individuals' disposition and competency (behavioral characteristics) by 360-degree competency assessment and utilization of AI
Data coordination infrastructure regarding education and career	Utilizing blockchain to support guardians/parents as well as job searching, job-change and lifelong learning, while protecting personal information

Importance of competency will increase in Society 5.0

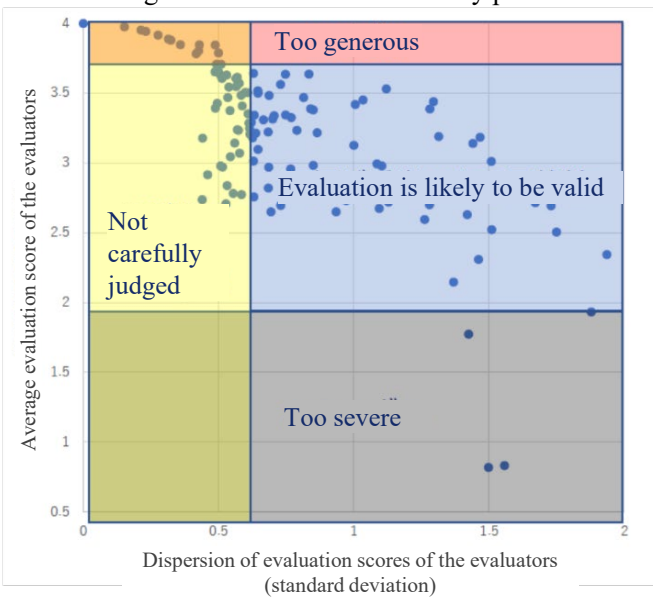


Competency is (overt) behavioral characteristics of human resources who receive high rating for their work as observed by others. It can be improved.

How can we measure competency?

- 360-degree analysis
- Accuracy of measurement depends on the quality of the evaluator

360-degree evaluation involves many problems



■ Overview of the presentations/opinion exchange at the hearings

○ In Japan data volume is absolutely insufficient in the fields of education and personnel and data is inadequate for the stage before the introduction of AI. Major axes of our efforts are constructing data for this purpose, producing insights and forecasts, providing education and constructing and operating a new system on block chain with enhanced personal information protection.

○ A big issue in Japan of today is that very few data are available in the education and personnel fields. Even when we have data, we cannot use the past data as they are, because of extreme sexism or excessive bias in various ways. Furthermore, insufficient consideration to the protection of personal information when obtaining the data sometimes gives rise to a problem.

○ When gathering data, we identify discrimination in the data and directly provide education to people conducting the discrimination. We use data for machine learning, etc. after removing discriminatory tendencies as far as possible.

○ It is safe to say that knowledge and skills will be important in changing society. However, it is also expected that when required knowledge and skills change, even highly rated people may become irrelevant. We are promoting initiatives with awareness of what we should think about in such situation.

For this reason, we need to obtain data of competency, which is a layer below knowledge and skills. It is said globally that data of competency is generally obtained by 360-degree assessment. However, 360-degree assessment in Japan is full of conjectures and it is meaningless to use its results as they are in personnel affairs and education. Our base structure is to make good use of machine learning after obtaining insights from data and making necessary corrections.

○ Our approach is removing bias from 360-degree assessment, or obtaining data of skills, and then utilizing the results for support for parenting, job search, job change and life-long learning in the manner of using community logs. We are experimenting with appropriate application to education in combination with white AI and activities similar to machine learning.

○ We are trying to create vast amounts of data while managing personal information by using block chains. By combining block chains, we are trying to create data in a safe way and obtain AI insights for application in education, for example.

○ Systems can demonstrate the protection of students' personal information in job hunting activities. The system allows student s to enter their grades and activities through smartphones and other devices, and allows companies to view such information, but the student data are encrypted and stored in a decentralized manner. The blockchain is used to make the data traceable, and the students themselves can choose to whom they want to disclose the information (company) as well as the scope of the information. The companies cannot extract information without permission thus personal information is protected.

○ It has become established in global ethical codes that white AI should be used in personnel affairs and education. Consequently, when sophisticated AI is used, we cannot fulfill ex-post facto accountability on why this personnel judgment was made or why this educational evaluation was made.

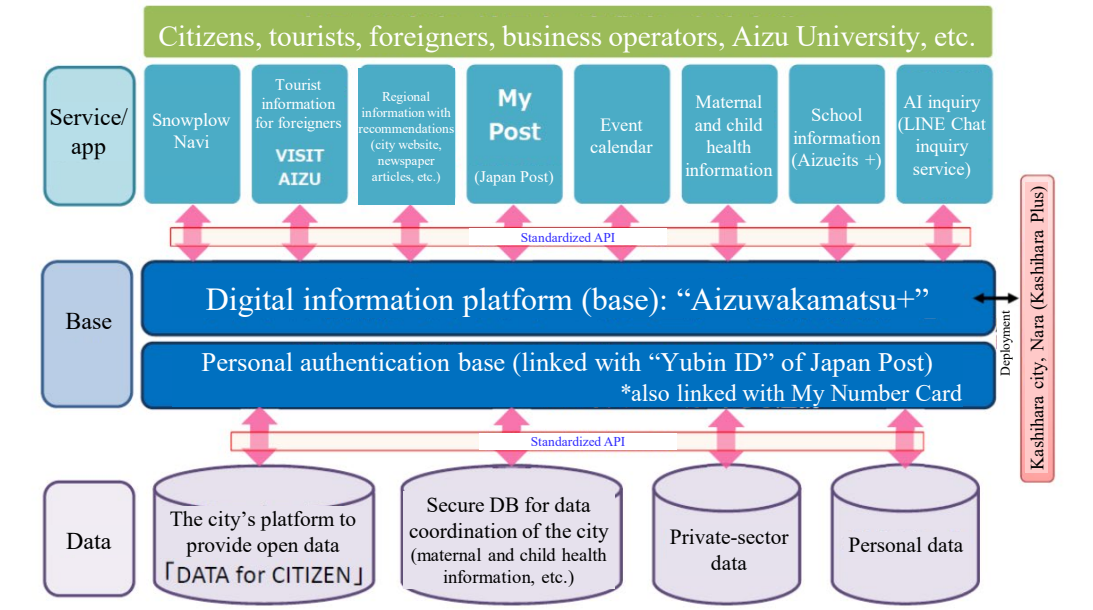
○ Especially in the fields of education and human resources, it is dangerous to entrust the work completely to AI. AI should only be used as a n auxiliary tool, and the final decision should be made by humans. Globally, the ethical direction regarding the difficulty of using AI decisions as an auxiliary tool without a clear understanding of why the decisions were made the way they were has emerged.

Aizuwakamatsu City: The role of AI in “Smart City Aizuwakamatsu”

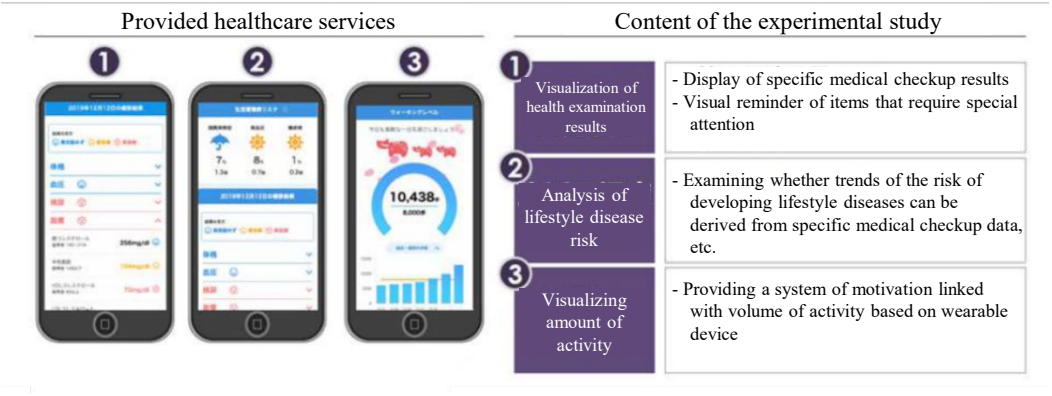
Summary of the key initiatives regarding AI development/utilization

Initiative	Summary
Platform that provides information with recommendations	Website that picks up and “recommends” information necessary for individual persons according to their attributes (age, gender, family structure, hobby, preference, etc.)
Sightseeing ×ICT	The multilingual tourism website presents tourist routes and contents according to the selected language, nationality of the viewer, timing of the visit, preference and other factors.
Chatbot inquiry service	Using LINE, AI answers inquiries from citizens 24 hours a day, every day.
Identifying and supporting people who may need support (e.g., DV, abuse, risk of solitary death)	Implementing a demonstration project of a system where AI is used to identify people who may need support (potential victim of DV or abuse, risk of solitary death, etc.) based on the welfare-related information held by local governments and to strengthen the support including watching over the identified.
Healthcare initiative linked with data of health examination and wearable terminals	Implementing a demonstration to score the risk of developing lifestyle diseases and display the score on smartphone. Providing and verifying the effectiveness of a function that calls attention to the need for improving health awareness.

Image of “Digital Information Platform” of Aizuwakamatsu City



Healthcare initiatives linked with medical checkup data and wearable terminals



■ Overview of the presentations/opinion exchange at the hearings

○ We build a platform that provides information with recommendations. By using AI, it can pick up information necessary for individuals according to their attributes including age, gender, family structure, hobby and preference and display “recommendations”.

○ In addition to multilingualization, our tourist website can present recommended sightseeing spots, destinations and plans according to the selected nationality/city of the viewer, scheduled days and favorite genres.

○ We provide AI chatbot service that can answer inquiries about garbage collection, and location of snow-removing vehicles, etc. Since June 2020, it can answer inquiries about COVID-19: available supports, and contact details when infection is suspected, for example.

○ In the demonstration for preventing abuse of the elderly (demonstration of the use of AI to identify potential targets of support—that is, those who may be suffering from domestic violence, abuse, lonely death, etc. —from information on welfare operations in order to strengthen support such as watching over them), big data related to abuse (household composition, age, income, disability status, etc.) was provided by the Ministry of Health, Labor and Welfare. After analyzing the tendency of high abuse using AI, we entered the data of the cases of actual households in the city and scored the possibility of abuse. Therefore, it was possible to obtain results with a certain degree of accuracy, as many of the cases that were recognized by AI as having a high possibility of abuse corresponded to actual abuse.

○ In the demonstration in the healthcare field, AI was used to determine the risk of developing lifestyle related diseases (hypertension, diabetes, and dyslipidemia) based on the results of specific medical examinations and other data. At the same time, the amount of activity was measured based on information from wearable devices, such as pedometers, and behavioral change was encouraged. The results showed that 95% of the users increased their health awareness and 89% changed their health behavior.

○ A challenge in introducing AI is considerable anxiety of users about privacy infringement. It is necessary to carefully respond to this anxiety.

○ It is important to explain in an easy to understand manner how AI will be used and what effects will be obtained as a result, so that users, such as citizens, understand and accept it. The use of data is on an opt in basis, and services are provided only after obtaining the consent of the individual. It is important for citizens to be convinced to use AI based services.

○ Sometimes city employees may lack knowledge and understanding of what services they can provide using AI, and what problems they can solve. There is a need for something like study meetings. It is also important to have knowledge and knowhow to communicate the convenience and safety of the services to residents.

○ In some smart city initiatives in the past, users were reluctant at first but gradually opened their minds through repeated talks with the persons in charge, which led to realization of the project. We feel that this is a community that greatly values human relationships. It is important to provide explanation with patience to obtain understanding.

○ A challenge is how to dispel anxiety of the elderly. For this purpose, it is important to create a foundation for fostering people who can teach how to use various digital tools and thereby help the elderly to learn to use them.

○ Standardization of city OS will facilitate horizontal expansion of various services across local governments. This will make it possible to introduce good services of other local governments swiftly and at a low cost without new system development.

○ We think that both ICT and AI are tools to enrich people's lives and make them happy. We will hold this human-centered viewpoint in focus.

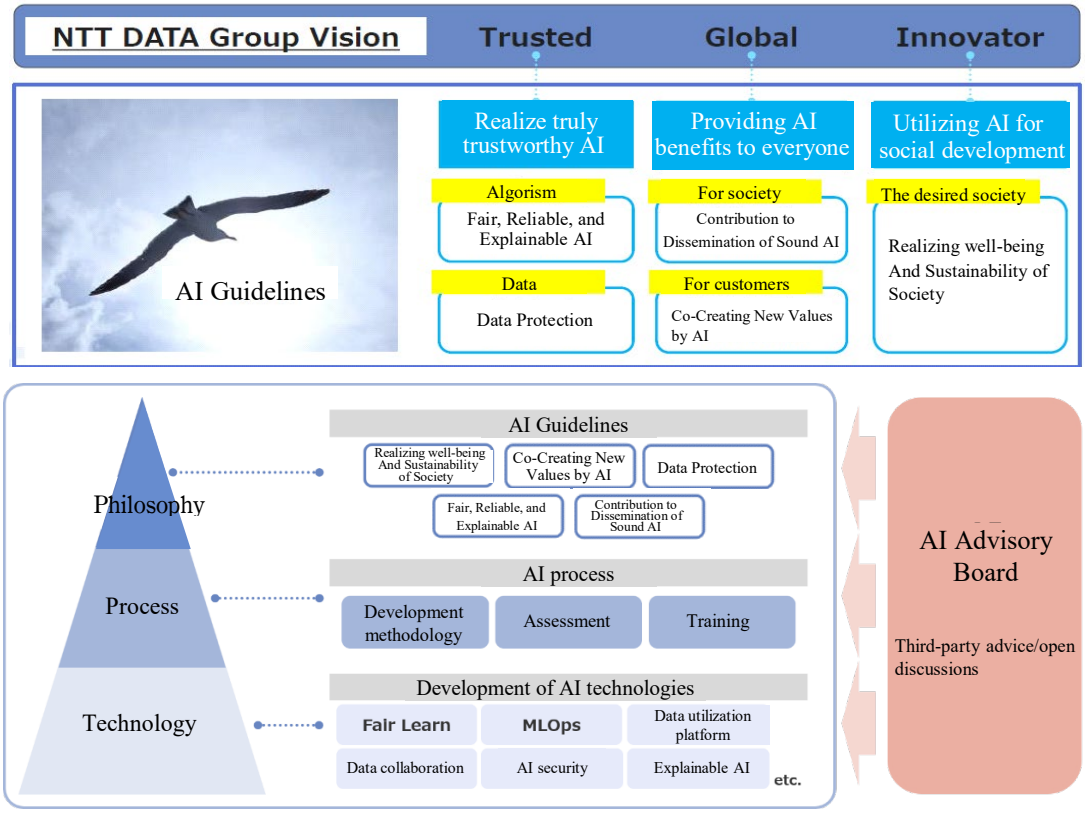
NTT DATA: NTT DATA Group AI Governance Initiatives, 2021 update

Summary of the key initiatives regarding AI ethics/governance

Category	Summary
Guidelines and principles	Toward a society where humans live in harmony with AI, we formulated "NTT DATA Group's AI Guidelines" in May 2019.
Development review	Developing an AI development methodology to strengthen governance that supports execution of the AI Guidelines. ・Developing R&D and management processes by gathering AI development knowledge. ・As development standards, we develop deliverable samples and other documents necessary for AI developers' manual work. ・We prepare an assessment tool that presents characteristics, risk and checking perspectives concerning AI quality in the form of a questionnaire.

Outline of the key initiatives regarding AI development/utilization

Initiative (COVID-19 countermeasure)	Summary
Contact detection	Detecting contact place and absence of mask



■ Overview of the presentations/opinion exchange at the hearings

○ We formulated "NTT DATA Group's AI Guidelines" in May 2019, developed AI development processes in June 2020 and started trials of AI projects in the company. In October of the same year, we created and

started trials of an AI quality assessment service to check individual projects based on a variety of knowhow.

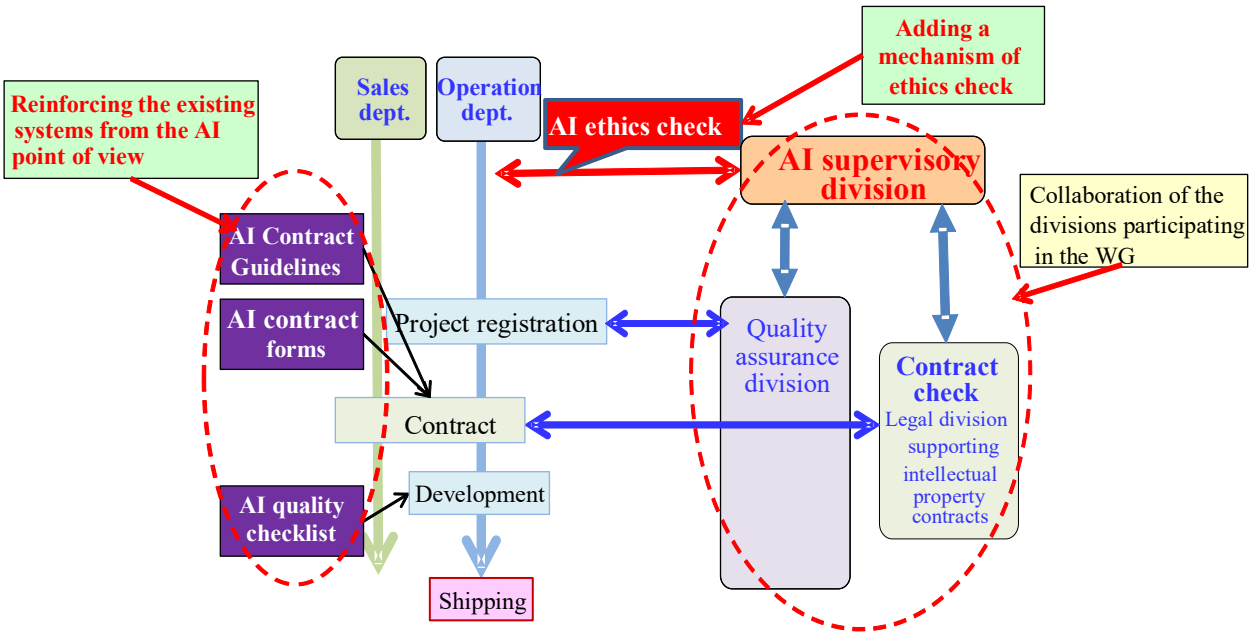
- ○ Following the formulation of AI guidelines, we developed a system of AI governance and technology. We created a philosophy for the AI guidelines; for it to take root in the field, it is necessary to develop some tools and techniques. We therefore constructed an AI development methodology. This is a methodology that provides “knowledge and processes,” “development standards,” and “quality assessment tools” so that the person in charge of the system development project can develop an AI system based on the AI guidelines.
- ○ We are handling about 300 AI projects and have consolidated the knowledge and developed a management process which each AI system developer and person in charge of the project can refer to in the development process. Since definitions of processes alone are difficult to apply for each project, we created samples of specific deliverables, required documents, and templates. In addition, AI quality is also important; we therefore prepared an assessment tool that allows evaluations to be conducted by using simple checklists and questionnaires. As an AI development methodology, we prepared a document that integrates the AI development knowledge, AI development process, AI management process, AI development standard, and AI quality assessment tool.
- ○ It is significant that we have defined the processes of AI development. We defined the roles and human resources (business analyst, data engineer, data scientist and machine learning engineer) necessary for AI development and explained the key tasks of these human resources in each process.
- ○ We identified and systematized necessary control items of AI management process based on Project Management Body of Knowledge (PMBOK). As major characteristics of the process, we assume two stages: model development (PoC) and system development (Systematization).
- ○ The point of our approach to AI quality assurance is that testing of the specifications alone does not necessarily guarantee the quality of the AI system. The quality must be considered comprehensively such as the characteristics of AI (model and data quality) as well as the characteristics of the software (use and product quality).
- ○ For AI quality management, we developed project inquiry forms and checklist along the flow of “project planning,” “implementation” and “retracement” and created a mechanism for self-check of possible risks when starting a project.
- ○ We provide a service where in-company experts supply feedback regarding AI quality assessment tools by using a function to report the results of the checklist and assessment of individual projects. Regarding the approach of AI quality assessment, we organized about 80 check items for each phase of AI design, data preparation and AI construction and evaluation from the viewpoint of system development.
- ○ Through these activities, we conduct PoC from the AI development and field points of view. This has an effect to clearly indicate specific approaches and solutions to address vague uneasiness. Other effects are improvement of project efficiency, quality and productivity.
- ○ Using the AI quality assessment tools, we could discover risks in actual projects. For example, there is a case where a model was created using data different from the data during operation and accuracy is insufficient because we failed to clarify the AI use scenario at the start. The risk assessment clarified the problems.
- ○ In the AI quality control process created by our company, measures have been taken to include a process that checks for bias in the original data using a checklist.
- ○ Our initiatives regarding safety/crisis management in the workplace to counter COVID-19 include development of AI that analyzes who took what action and touched what in the office based on videos.

OKI: AI Risk Management of OKI

Summary of the key initiatives regarding AI ethics/governance

Category	Summary
Guidelines and principles	OKI Group AI Principles were formulated in September 2019 to contribute to people's comfortable and rich life by providing AI capable of appropriate coexistence with people.
Organization and structure	Risks involved in AI development and utilization are registered as common risks under the company-wide common management and our AI supervisory division spreads measures to prevent materialization of the risks in the group. A working group was set up to check ethical perspectives and legal risks.
Development review	We created the "AI quality checklist" for AI projects in order to check key activities of product development, while at the same time creating a checklist guide and glossary. We released "AI Contract Guidelines" organizing promises to be made with customers in each business step, while creating "contract forms" incorporating the content of the AI Contract Guidelines.
Cooperation and collaboration with external parties	Promoting development of human assets with practical skills and implementation of AI in society in comprehensive collaboration with Chuo University.
Human resource development	Strengthening AI human assets with practical skills by developing an AI education system for each job type.

Quality management system for provision of AI products/solutions



■ Overview of the presentations/opinion exchange at the hearings

○ In FY2019 we set up a companywide AI environmental improvement project. Promotion of AI business requires improvement both in technical and nontechnical aspects, but this project focuses on nontechnical

aspects.

○ We set up a working group to check ethical aspects and legal risks when providing AI products, or to study schemes for checking.

○ When considering structures and operations, we basically intend to use existing internal rules and structures as far as possible. In this way we are constructing a mechanism under which risk management regarding AI can be accepted without resistance in the company.

○ The company including salespeople, system engineers, developers and researchers compiled an AI contract guideline organizing the promises to be made with customers, activities in the company and things that should be noted during each stage from customer consultation to product provision.

With reference to the guidelines of the Ministry of Economy, Trade and Industry[93] we created AI contract patterns (for each stage of technology verification before PoC, PoC and formal agreement) by identifying promises to make to prevent materialization of risks unique to AI and adding these to the existing model contracts.

○ With reference to the guideline of QA4AI Consortium[94] we sorted check items in quality activities and compiled an AI quality checklist in line with the OKI development process. We also created a user's guide and glossary for this checklist.

○ In FY2020 we added risks regarding AI R&D and utilization to the common risks to be managed across companies and divisions of OKI Group. The newly added AI risks are supervised by the innovation promotion center. The activities cover quality management, human asset development and other matters that were considered in the AI environmental improvement project.

○ In order to prevent risk materialization, we conduct regular monitoring to make inquiries to individual departments to check the progress of measures and identify challenges. We also make the issue known in the company through e-learning on compliance, distribution of case examples and posting on the house journal.

○ We are reinforcing quality management so that it can support AI products, centering on the quality management system operated in the existing solution business. At the stage of contracting with customers, the company refers to the AI contract guidelines, contract templates, AI quality checklist, etc.

○ In order to identify ethical and legal risks of AI, we have introduced a mechanism of AI ethics check. Using the mechanism, the AI supervisory group checks what kind of data is handled, whether or not the data include personal information and identifies risks in cooperation with experts of the legal, intellectual property, business and sales departments. For legally complex cases, we ask cooperation of specialized lawyers.

○ In the new normal, it is necessary to accelerate technology development in the light of the acceleration of manpower saving and AI introduction in operations, need for forecasting systems in response to big changes in society (discontinuous changes that make past data unusable) and need for maintaining supply chains across industries. With regard to maintaining supply chains, in particular, we think that it will become necessary to increase their resilience to return to the normal state after cutting off of a part due to earthquake, etc. or global disruption caused by COVID-19.

○ AI is good at activities that can be stylized or formulated. Desirable role sharing may include leaving preprocessing of entry sheets and other tasks to organize typical parts for drafting and tasks that require objective assessment avoiding subjectivity to AI, while human beings make evaluation based on the results.

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[93] See Note 80 above.

[94] See Note 81 above.

○ We have defined human capital levels and created portfolios. We created a training system for each level and type of work, and are providing training to raise the level of skills throughout the group.

○ For AI literacy education, we are developing an e-learning program for all employees, and more than 7,000 people have taken the course. In addition, we made videos explaining the points to consider in AI business and the AI contract guidelines, and are using them in AI sales education, AI engineer education, and AI business education.

○ AI business education, workshops on risk checking are conducted so that participants can experience it themselves. In addition, in terms of AI engineer education, we are focusing on classroom based learning and are also collaborating with universities for practical education. The aim is to increase AI human resources by having university faculty members provide practical training to employees based on their projects. projects.

Sony: Sony Group's AI Ethics Activities

Summary of the key initiatives regarding AI ethics/governance

Category	Summary
Guidelines and principles	Formulating "Sony Group AI Ethics Guidelines" in September 2018 based on our prospectus, mission vision, Code of Conduct, etc.
Organization and structure	Setting up an AI Ethics Committee consisting of a steering committee (executives), working-level members (directors) and working groups.
Development review	Confirming conformance with the policies of AI Ethics Guidelines in alignment with existing agreements and assessments. Developing assessment tools for each phase of planning, development, mass production and post-release (check tools for fairness and documentation for transparency).
Transparency and accountability	We implement initiatives to ensure accountability, which include explanation of customer experience values and risks to stakeholders. For this purpose, we implement initiatives for transparency including preparation of materials for the explanation and development of eXplainable AI.
Cooperation and collaboration with external parties	Actively promoting collaboration/cooperation with domestic and overseas stakeholders including governments and international organizations.
Human resource development	Implementing AI ethics, data compliance and other education through e-learning for all employees who can take the course. Holding symposiums, dialogues and lectures by specialists.

Cooperation and collaboration with external parties

* Partnership On AI (PAI)
* Ethics+Emerging Sciences Group at Cal Poly
* Business for Social Responsibility (BSR)
* Microsoft for IMX-500*
* Federation of Economic Organizations: AI Utilization Strategy
* Cabinet Office: Council for Social Principles of Human-centric AI
* Cabinet Office: AI strategy expert meeting
* MIC: Conference toward AI Network Society
* OECD GPAI AI and Pandemic Response SubGroup

■ Overview of the presentations/opinion exchange at the hearings

○ In September 2018, the "Sony Group AI Ethics Guidelines" were released. They defined seven principles with reference to Sony's Founding Prospectus, Mission/Vision, and the Sony Group Code of Conduct. In March 2019, they were revised to align with Sony's Purpose & Values. The guidelines consist of positive expressions, rather than expressions of "what not to do."

○ Structure of our AI ethics committee is: a steering committee of executives under which there is a working-

level committee consisting of directors of legal, privacy, quality management; and other departments under which there are five working groups (technology, assessment, education, information dissemination and external trend survey). The working-level committee aims to execute the AI ethics guidelines while communicating with individual business units and indirect departments.

- ○ The AI ethics assessment process has an iterative part in actual agile development, but the typical process consists of planning, development, mass production, sales and release. In this process, we have events in the quality management system. For example, we conduct assessments by checking AI ethics before the design stage toward AI Ethics by Design.
- ○ Our assessment sheet includes detailed check items for the planning stage and the start of development/design. Finally, we check whether these items are duly executed or not. After release, we also check incidents in the market through monitoring.
- ○ Our activity starts from thinking about how to check bias regarding sensitive attributes and the question of what sensitive attributes are in the first place, but this judgment is difficult. For example, when race and gender are found to be sensitive attributes requiring special attention, we check multiple items including possible biases and stereotyped learning.
- ○ Regarding fairness, we recognize that it is difficult to determine what is considered sensitive. In the areas where it has been identified, we have established check rules and databases for fairness. For example, in the detection of people, we are building a database and tools that check for racial bias.
- ○ With regard to consideration to diverse stakeholders, we check the consideration given to minority stakeholders including people with disabilities and children, for example.
- ○ We think pursuing transparency is necessary for dialog with stakeholders. This means that we should prepare a mechanism to show the grounds for description of and judgment on the data or model.
- ○ Dialog with stakeholders is the process of sharing possible benefits and losses, namely sharing understanding of negative accountability impacts on stakeholders, which are related to the benefits of the stakeholders, and building a system for this purpose.
- ○ We are being proactive in external collaboration, as we believe that there are aspects that we cannot solve on our own. Thus, in addition to the activities included in the material (See above), we participate in activities such as "ISO / IEC JTC1 / SC42.[95] We also cooperate and collaborate with "Business for Social Responsibility (BSR)," Microsoft and other partners.
- ○ For education and awareness, e learning was introduced in 2019 as mandatory for all employees who are eligible. It is introductory, and includes what is AI ethics, AI ethics incidents that occur around the world, and the outline of Sony Group AI Ethics Guidelines, the outline of data compliance, especially how to collect data, and how to be aware of bias.
- ○ We organize symposiums and lectures by specialists and dialogs with experts in and outside the company. Information from these activities is shared and disseminated through our enterprise information portal. We also disseminate information through external websites and organize external collaboration.
- ○ In order to spread the activities across the company and the group, it is necessary to carry out AI governance and management in this manner. It is important to make this kind of assessment rule in order to improve the overall level, or to raise awareness of employees who assume that it has nothing to do with them.

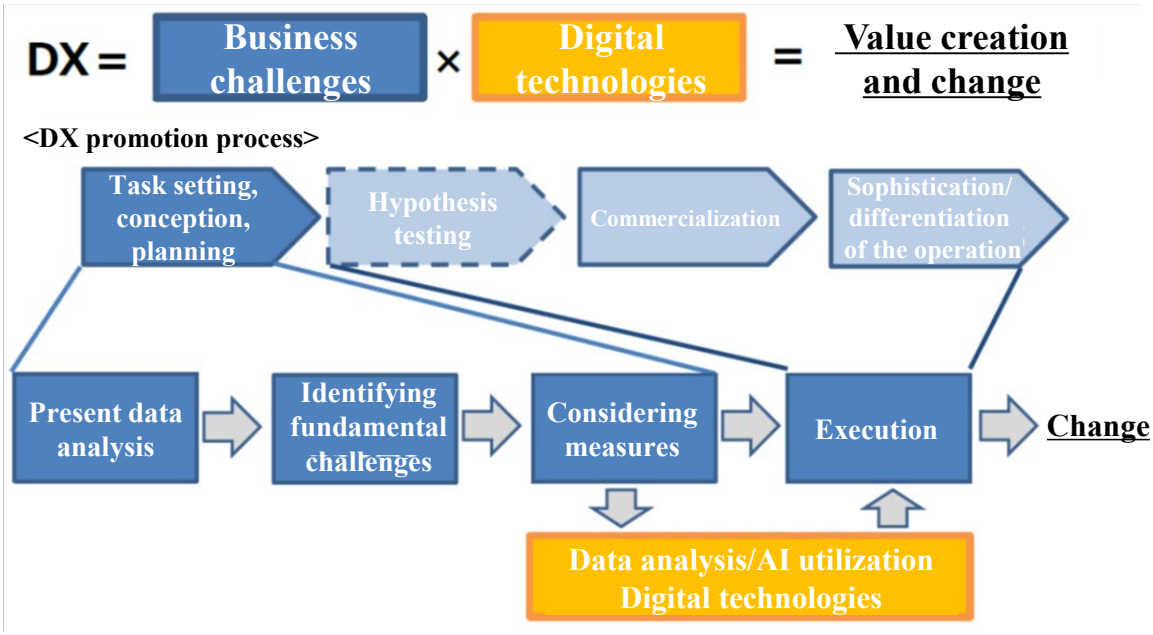
[95] See Note 82 above.

Sumitomo Corporation: DX Promotion and AI Utilization in the COVID-19 crisis by Sumitomo Corporation

Summary of the key initiatives regarding AI development/utilization

Initiative		Summary
Initiative of digital transformation (DX)		
	DX (digital transformation) promotion system	We established a DX center as a specialized organization in April 2018 and have been promoting DX in cooperation with the company's operating divisions, regional organizations, external partners, etc. We established Insight Edge, Inc, which is specialized in DX technologies, in July 2019. The in-company engineer organization is working for agile development, data analysis and AI model development which are essential for digital transformation.
	Points of DX and digital technologies	Digital technologies including data analysis and AI utilization are important in the process of promoting DX (solving business challenges by digital technologies for value creation and change).
Examples of AI utilization		
	Flaw detection in manufacturing sites	Demonstrating flaw detection using image analysis technology
	Semi-automation of operation and quality improvement	Semi-automation and quality improvement of merchandize registration by using natural language processing (NLP) technology
	Utilization of prediction/simulation models	Improving decisions that depend on intuition and experience by decision support by AI. ・ Optimizing ordering/inventory in trading by using market/price/demand prediction models. ・ Improving success rate of new businesses through utilization of simulation models.

Points of DX and digital technologies



■ Overview of the presentations/opinion exchange at the hearings

○ The Process of DX promotion is a cycle of: analyzing present data, identifying challenges, determining fundamental challenges based on priority, planning measures to address the challenges, repeating tests of the hypothesis, commercialization, and materialization in operation toward sophistication/differentiation. Data analysis, AI and digital technologies are very important for running this cycle.

○ Digital transformation is rarely successful in the first attempt. The process of getting closer to the right answer by running the cycle and the speed of running the cycle are crucial.

○ In the case of semi-automation of operation and quality improvement, visual inspections and determinations by human operators are used in various operations, and thus involve variation and mistakes. We are trying to reduce mistakes, improve quality and reduce processing time by using AI.

○ Regarding use of prediction and simulation models, selling a large number of items involves frequent occurrence of surplus stock and stock shortage. In another case, if you know whether prices will increase or decrease at the time of shipment, you can make a change in profits by adjusting the timing of shipping or contract. We are trying to solve the challenges by introducing prediction models.

Trading companies start many new businesses but about 90% of them fail. In order to understand the success factors beforehand using mathematical models, we are creating simulation models with the aim of improving the success rate of new businesses.

○ With the increasing speed of technological innovation, business leaders are required to rethink business management. Today successful approaches and models do not last long. In this situation, the managements' lack of understanding of technologies is overwhelming. Understanding of technologies will become indispensable for management in the future.

In addition, institutional design is necessary for utilization of digital, data, AI and similar technologies. For example, it is important to develop a specialized promotion system, recruit experts from outside and train in-company human resources. Furthermore, the personnel design, personnel system, human resource development and evaluation should be conducted as a package.

○ While the spread of COVID-19 continues, corporate performance and the economic environment are

improving. However, non-digital operations and management structures are still required. It is therefore important to utilize digital and AI to reduce costs and improve productivity. In addition, it is necessary to seriously consider increasing the success rate of new businesses; it is important to select projects and focus resources for new businesses. Furthermore, it should be possible to use AI to remotely negotiate and coordinate with those who understand local operations and businesses f or overseas projects. It is then expected that the number of successful cases will increase.

- For agile development, we are trying to employ engineers with experience as an IT architect, full-stack engineer, etc., but we find only a limited number of ideal candidates in the market. We have been proclaiming agile development in the past 10 years, but we are yet to acquire people who can do this. The difficulty may be a problem of the entire IT service industry, which requires improvement.

LegalForce: Introduction of a contract review and management system using natural language processing

Summary of the key initiatives regarding AI development/utilization

Initiative	Summary
Contract review	Supporting contract drafting with functions including contract review, text search, difference comparison and comparison of similar texts
Contract management	Automated management of signed contracts by digitalization of contract documents, automated extraction of project information, efficiency improvement of provision search, management of renewing deadlines, etc.

■ Overview of the presentations/opinion exchange at the hearings

○ We handle contracts by using natural language processing technology. There is a strong need for the service

because a large number of contracts are used in business, but it is difficult to read contracts. We have developed products with focus on this issue.

○ Operations regarding contracts involve five steps: (i) the sales, operating, R&D or other department requests the legal department to draft or examine the contract document before concluding a contract; (ii) drafting/examination of the contract; (iii) negotiation; (iv) concluding the contract, and; (v) storage/management of the contract.

○ At the stage of drafting a contract, the contract is checked by the human eye and reviewed the hard way. Elimination of disadvantageous provisions to prevent damage to the business value and checking for omissions are time-consuming and heavy work.

○ With the aim of supporting review by using AI, we are developing products under the concept of "mistake-free, quick and comfortable contract review" (Note: the concept was changed in April 2021.).

○ For example, AI points out issues such as: "the scope of the disclosure of confidential information may be too wide" regarding non-disclosure agreement, "special damage, indirect damage including lost profits and legal fees may not be paid" regarding compensation for damage, and presents how to correct the provisions.

○ When matters that should be included are not included, AI detects this and issues an alert. Finding something left out is very difficult for humans and requires step-by-step checking with a checklist. AI can make a difference in this kind of operation.

○ Sometimes contracts are drafted with reference to past contracts. For this purpose, we provide functions to search for past contracts, present differences between the contract in the process of being drafted and the past contracts to improve operational efficiency and reduce the time for drafting.

○ After signing a contract, the contract document needs to be managed. Many contracts have been stored in the company's cabinet as paper documents. When there is an inquiry about contract content from the operation divisions, etc., it is a difficult work to find the required contract from among so many contract documents.

○ In order to support contract management by using AI, we are developing products under the concept of "automated management of concluded contracts: you can find anytime" (Note: the concept was changed in April 2021.).

○ Contract documents are scanned and subjected to an optical character reader (OCR). Then, AI automatically extracts important information and the information of the case and makes the information into a database. This enables full text search as well as management of contract renewal deadline.

○ Because we employ lawyers and paralegals in the company and the legal professionals engage in development, we can use their deep insights. As a result, we can secure AI quality and improve products from the viewpoint of legal practice.

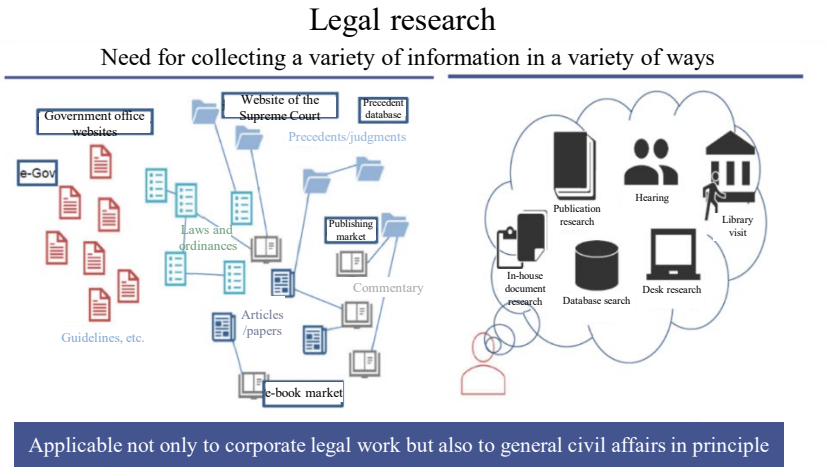
○ We think that machine learning can be used effectively because each type of contract has some patterns. Furthermore, average Japanese is very difficult to process due to omissions of a subject, but the subject is correctly provided in contracts, which we think makes analysis easier. Difficulties include terms and structures unique to contracts and the necessity of having a person with contract knowledge assign teaching labels for machine learning

○ Contract review cannot be completely left to AI. Final judgment is made by human beings. For this reason, we think that, assuming legal knowledge, use of AI may fit the need to do contract review quickly and without errors of omission.

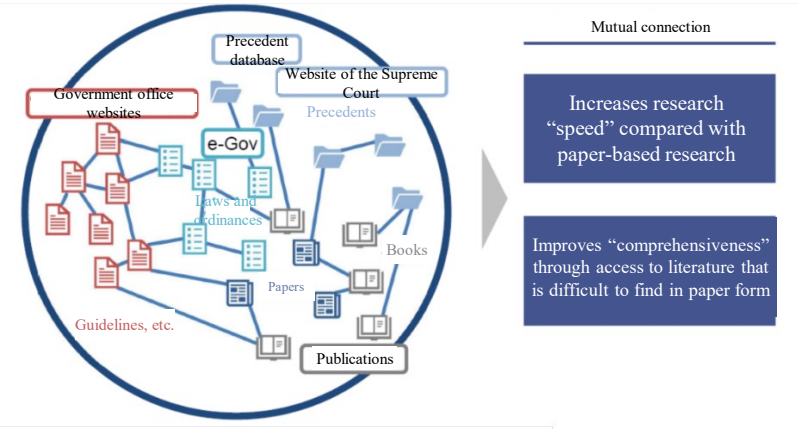
Legalscape: Efforts toward organizing legal information into web-like structure

Summary of the key initiatives regarding AI development/utilization

Initiative		Summary
Creating a web of legal information		Organizing all legal information for use by everyone through AI analysis (natural language processing) and “connection” based on mutual reference relationships, etc.
Current initiative		
	Converting legal information into open data	Supporting disclosure of legal information, which is necessary for construction of a legal web Example: supporting all case disclosure by the government (courts, etc.) through provision of an automated anonymizing technology for judgment documents toward use by everyone.
	Providing legal search tools	Supporting research (legal research) for judicial judgment based on laws/ordinances, books, judgment documents, administrative guidelines and other law information through construction of a legal web
Future prospect (example)		
	Developing “infrastructure of laws”	Supporting automation of affairs for law-making, amendment and operation.



Legal web



■ Overview of the presentations and opinion exchange at the hearings, etc.

○ When making some sort of judicial judgment, it is necessary to investigate scattered legal information (laws/ordinances/ judgments, administrative guidelines, books of commentary, etc.)

○ Professional lawyers conduct research using a mass of books, database of precedents and personal knowledge and explain the result to the client, but it takes a lot of time. In-depth research of legal affairs is almost impossible for an ordinary person. As a result, legal information is not effectively used in Japan.

○ For example, judgment documents in paper can be read in courts and about 60,000 of the most important precedents are disclosed on the website of the Supreme Court. In addition, by paying about 10,000 yen a month, you can read about 300,000 documents in a commercial database used by lawyers, etc. However, several hundreds of thousands of judgments are issued every year in civil trials alone. We think that only a very small part of the whole is disclosed.

No-action letters (prior confirmation procedures on the application of laws and regulations), guidelines, public comments and other documents of government offices are generally published as PDF files on their websites. However, they are not retrievable, you don't know where they are, or there are multiple versions causing confusion. Documents of government offices are closely connected with laws, etc. and therefore indispensable information for operation of and compliance with laws that should be understood as a whole, but these are disclosed in a way that does not allow appropriate use.

○ The company gathers various laws, ordinances (enforcement ordinances), ministerial ordinances (enforcement regulations), guidelines, commentary books and other legal information in Japan, which are very closely related, analyzes the information through natural language processing and "connects" them based on their reference relationships. We call the legal information that is "connected" in this way the "legal web." It is expected that the initiative will not only accelerate research but also enable exhaustive research by reliably finding information that is often passed by (mentioned in old public comments, for example)

○ First, with the aim of collecting all information accessible as electronic data, we are digitalizing information using our own patented technology with focus on laws and regulations, PDF materials posted on websites and book data. The next stage will be collaboration with courts and government offices. We think that if we can compile a database of paper materials including judgment documents stored in individual courts and materials held by government offices, we will get closer to the realization of our vision: a landscape that organizes all legal information for viewing at a glance.

○ At present, we mostly handle laws, ordinances, administrative data and books to provide services targeting

lawyers and corporate legal affairs departments. For the future, we will organize more legal information including precedents by advancing open data in the legal field toward a view of a landscape covering all legal information (legalscape). We are planning provision of wider scope of services accordingly.

○ We are also working to convert judgment documents into open data. Several hundreds of thousands of judgments are issued every year in civil trials alone, but only a small part of them is disclosed for privacy reasons. Last year, The Japan Law Foundation organized a project team to study how to convert civil judgments into open data. The team considered automated anonymizing of personal names and dates (replacing them with symbols in a way that maintains the meaning of the sentence) in order to solve the privacy issue associated with disclosure, and took charge of the demonstration experiment. If adopted, this approach is expected to enable low-cost disclosure of all judgment documents in Japan.

○ Research tools centering around the legal web concept will enable in-depth research by unifying legal information for easy search and viewing and by automating display of mutual reference relationships. Because these tools enable easy and low-cost legal research including law research and law drafting/amendment, some law firms and corporate legal departments have already started to use them.

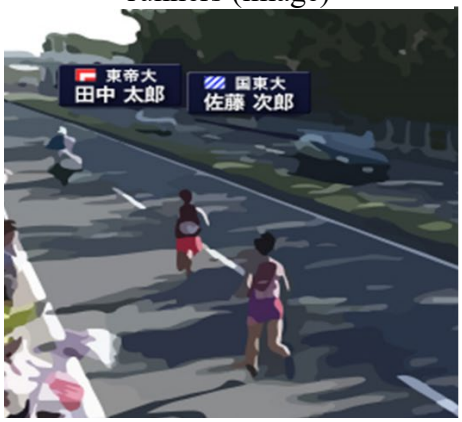
○ One of the benefits of the legal web concept is support for law drafting and revision in the future. At present, maintenance of laws (drafting, revision, etc.) is handled by humans, but some legal documents including acts for revision of other acts (amendment sentences) exclude ambiguity and allow only one interpretation as is the case with programing language that is called formal language. We think that we can start from supporting maintenance of such documents with computers.

Nippon Television: Introducing the AI utilization case study and AI utilization promotion system of Nippon TV

Summary of the key initiatives regarding AI development/utilization

Initiative		Summary
Program rendering		
	Android announcer	The world's first android broadcast announcer attended the initiation ceremony of the group in April 2018.
	Chatbot	AI character in a drama is reproduced as a chatbot on LINE.
	Recognizing runners of Hakone Ekiden	Immediately recognizing runners of each university in outdoor broadcasting of Ekiden. Automated generation of lap time CG and inter-runner distance CG data
	Rugby speed recognition	Visualizing running speed and total running distance of players in game live.
	AI catcher (baseball)	Presenting the best type and course of pitch to prevent point loss.
Operational improvement		
	Face recognition	Automated person determination of objects in news program, contributing to prevention of false report, reduction of the burden of prior confirmation and improvement of on-air rate
	Automated CG selection	Recognizing the face of objects for automatic standby of the CG introducing the persons.
	AI caption	Automating transcription of recorded interviews and other materials for program production.
	Automated manuscript recap by AI	Automatically creating summaries of news articles, etc. based on knowhow of manuscript production.
	COVID-19 countermeasure (Maskn)	Detecting mask wearing based on camera image recognition.
Business		
	Viewer rating prediction	Predicting program rating based on the broadcasting time, review by viewers, distribution by other media, etc.
AI liaison committee (AI utilization promotion system)		Setting up an AI liaison committee to share information of an in-company AI project across the group.

Recognition of Hakone Ekiden runners (image)



Face recognition (image)

■ Overview of the presentations and opinion exchange at the hearings, etc.

○ In program rendering area, android announcer Aoi Erica joined Nippon TV in 2018 and was widely active in program/distribution planning and appearance in events. In addition, we transformed a character appearing in a drama named “AI Nana” into AI to work as a chatbot. The Chatbot was used by about 1.3 million users in one month after the launch and had nearly 300 million conversations, greatly contributing to the excitement of the program.

○ With regard to operational improvement, we used recognition of Hakone Ekiden runners for our program. Usually, people are recognized by their faces, but uniforms were used for recognition in the case of Hakone Ekiden. Face recognition is difficult because the runners’ face is often difficult to see, they are looking away or back, wearing a pair of sunglasses, or look completely different in the latter half due to a severe race. Furthermore, face recognition requires learning every year, whereas uniform recognition can be used repeatedly without new learning.

○ CG display of lap time had a significant effect on operation. Usually, creating CG is hard work of checking with the human eye, while continuously looking at videos of multiple traveling vehicles. By using AI, we always know who is on the camera and where they are. Automation was made possible by combining the traveling vehicle’s GPS and range meter data.

○ We developed real-time display of the on-air time of each university and used the display as a tool. In order to show the universities as equally as possible in term of time, we used the time display for switching scenes. We also used AI to estimate and display distance between runners. The point is the use of the existing cameras without mounting new sensors on the outside broadcasting vans.

○ In broadcasting of the rugby World Cup, we used AI to measure and display running speed per hour and the distance that players ran carrying a ball.

○ In professional baseball, AI learned past data and determined where the pitcher should throw the next ball.

○ In program production, there is a challenge or need to identify the object. Because misidentification of a subject leads to false reporting, we hope to eliminate this while at the same time improving the efficiency of subject identification for swift reporting. We are doing double checks and triple checks to prevent false reporting, but this takes labor and time and sometimes we cannot make it in time for on air. To address this issue, we introduced an AI face recognition system for automated identification of persons on camera and for displaying on the screen for reference.

This was useful for preventing false reporting and reducing working hours, which contributed to improvement of operational efficiency and reduction of burden on workers.

The on-air rate was also improved through reduction of confirmation time.

○ There is a system of automated summarizing using AI. The system automatically extracts truly important parts as highlights from original texts to post on websites or distribute via SNS.

○ For business, we predicted view rating. It is very difficult to predict view rating of programs handling different content every week. We used AI for prediction and negotiated purchase with film distributers based on the prediction.

○ It is said that face recognition has race differences, but players of different countries are correctly recognized in broadcasting of the rugby world cup. It is considered to have reached a practical level.

○ Regarding the automatic summarization of AI manuscripts, the system is still in the experimental stage however, it is envisioned that the system will first automatically create a summary, and then a person will check the result and make corrections before posting it on the website or sharing it on social media. The intent is not to distribute or air the results of AI summaries as they are, but to have a person perform a final check; it is operated in this manner under such a policy for any AI. The idea is to maximize AI as much as possible, but only to support humans.

○ The AI Liaison Committee was established in August 2020 as a system to promote the utilization of AI. The aim is to create a mechanism for sharing information on the challenges of initiatives throughout the Nippon TV group and to minimize the risk of unnecessary investment. The idea is to freely share AI related information and enhance companywide knowledge and share information on AI projects across the Nippon TV group, while also considering the introduction of efficient AI technology by sharing successful and unsuccessful examples. In addition, it is an equal place for creating new initiatives utilizing AI for employees from various workplaces, including production, to gather and share information.

NHK Science & Technology Research Laboratories: Efforts to develop AI technology at NHK Science & Technology Research Laboratories

Summary of the key initiatives regarding AI development/utilization

Initiative		Summary
Smart production		Using AI technologies for R&D on technologies to support program production and human-friendly broadcasting.
Intelligent program production		
	Social media analysis system	Real-time extraction and presentation of social media information by 24 categories including fire, traffic accident and flood damage to support reporters in program production.
	Automated manuscript production system	Example: automated drafting of news manuscripts based on the present disaster situation (river water level) and a mass of past manuscripts
	Video summarizing technology	Automatically picking up key scenes and producing digests and short videos for distribution via SNS
	Automated colorization of black and white videos	Supporting production of programs that use colorized black and film videos
	Japanese-English machine translation system	Supporting English news production on TV, radio and the Internet by automated machine translation using neural networks
Universal service		
	Caption creation based on voice recognition	Supporting caption creation by recognizing announcers' voice Verifying the accuracy of automated voice recognition in live programs of local news
	AI reporter	AI who has learned a mass of news manuscripts and announcer knowhow reads news in a way unique to NHK.
	Automated production of radio weather information program	Announcing weather information by a synthesized voice on the radio
	Producing sign-language content using CG	Providing sign-language CG services in the field of weather and sports where there are many stereotyped expressions
	Automatic addition of explanatory speech to broadcast speech	Adding automatically generated explanatory speech in an appropriate timing considering the overlapping with broadcast speech.
	Tactile presentation system	Presenting tactile information in time with the video through a device

Social media analysis

Sign language content production using CG

■ Overview of the presentations and opinion exchanges at the hearings, etc.

○ Since 2018 we have been promoting smart production using AI and actively using AI for intelligent program production and universal service.

○ Our social media analysis system extracts Twitter information real-time by 24 categories including fire, traffic accident and flood damage. The result is used by reporters for program production. Originally, useful tweets were determined by humans, the result of which is now used as learning data. About 10% of all Japanese tweets of the day are analyzed and used.

○ The video summarizing technology can summarize videos and pick up key scenes to produce digests and short videos for the program's website on SNS and distribution. The technology provides weighting in terms of the ratio of facial close-ups or zoom-ins to generate short videos accordingly.

○ Technology of automated colorization of black and white videos supports production of programs that use precious black and white film videos after colorization. In the past, it took several days to colorize black and white pictures one by one. Today we can reduce the time to several minutes or about one hour for a short video.

○ We have constructed a Japanese-English machine translation system with the aim of supporting English news production on TV, radio and the Internet. This was realized by the development of high-quality parallel translation data and learning of translation models based on neural networks. NHK news manuscripts are characterized by long sentences and translation of one Japanese sentence often results in two or three English sentences. This challenge was also solved by learning of parallel translation data using NHK news.

○ In our universal service, we are working on automatic captioning, voice guide and sign language CG as human-friendly broadcast technologies.

○ We started captioning by voice recognition in 2000. When direct voice recognition is inadequate under a noisy environment, we repeat the utterance in the studio to ensure clear recognition.

We are experimenting with automatic voice recognition captioning of local news to examine the level of correctness of captions totally based on automatic recognition. We are conducting experiments concerning whether dialects can be recognized correctly. We hope to use the results for specific services.

○ Our AI reporter learned news reading of NHK announcers and read manuscripts in a news show.

○ With regard to automatic production of weather information program on the radio, we are tackling a

technology to communicate weather information with a natural and smooth synthesized voice by taking advantage of knowhow of NHK announcers who communicate weather information on the radio.

○ With regard to the automatic addition of commentary audio to broadcast audio, we are researching a system that enables visually impaired people to enjoy live broadcasts by automatically generating commentary audio to complement the program and overlap ping it with the broadcast audio.

○ Regarding the generation of sign language content using CG, currently, the number of sign language broadcast s is not increasing due to the lack of sign language newscasters. However, since weather and sports are easy to handle because of their many standardized expressions, work is being done to provide sign language CG services in these fields.

○ With an automatic manuscript preparation system, we obtain various data to use for reporting and prepare news drafts based on the mass of manuscripts prepared in the past. For example, when we select river water-level information such as “reaching a dangerous water level” or current water level, the system can prepare a draft corresponding to the information. Based on the draft prepared by the system, human editors determine the need for correction or deletion and prepare the final manuscript.

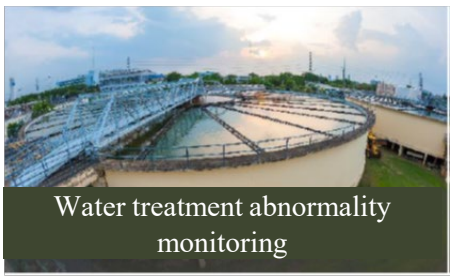
○ In subtitle creation by voice recognition, recognition errors are finally corrected by human beings before broadcasting.

Toshiba: Toshiba's AI Initiatives

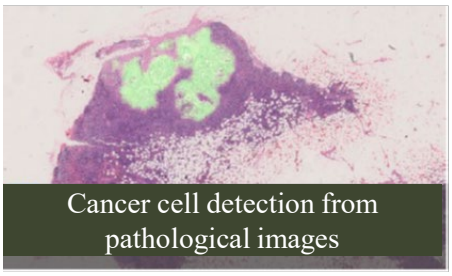
Summary of the key initiatives regarding AI development/utilization

Initiative		Summary
AI technologies		
	Factorial analysis	Extracting factors from data that includes many missing values
	Explainable time-series abnormality detection method	Determination of normal or abnormal based on waveform fragments obtained from normal waveforms alone
	Image abnormality detection	Detecting abnormality at high accuracy using normal image data alone
	Crowd measurement	Analyzing the density and number of people in images (videos)
	Real-time subtitling system	Distributing subtitles real-time in university online lessens
	Optimization of power plant operation (optimal load distribution)	Creating economical power plant operation plans
	Simulated diverging machine	Innovative combination optimization engine based on quantum computer theory
AI utilization solution (use cases)		
	Image deep learning	Transmission line inspection by drone, combustion image analysis, visual inspection, die casting defect sign detection, semiconductor wafer defect image classification, cancer cell detection from pathological images
	Prediction/abnormality detection/factor estimation	Power demand estimation, productivity improvement of semiconductor factories, work behavior estimation in warehouses, water treatment abnormality monitoring, detection of unsteady state of buildings, optimization of service parts stock
	Voice, natural language and knowledge processing	Work style change, content production/inserting equipment
	Disease prediction	Predicting lifestyle disease risks and providing improvement proposal services
Human resource development		Increasing AI human resources who support the Cyber Physical System (CPS) by introducing practical education utilizing real data held by the company

Transmission line inspection by drone



Water treatment abnormality monitoring



Cancer cell detection from pathological images

Optimization of service parts stock

■ Overview of the presentations/opinion exchanges at the hearings

○ We are developing business by utilizing our basic AI technologies including image recognition, voice recognition, synthesis, text and time-series data for solutions in the social infrastructure and industrial fields, which include manufacturing and power plant processing.

○ We have established AI quality assurance guidelines in the company and constructed a system to provide high-quality AI based on the guidelines. We are promoting utilization of AI in social infrastructure by making full use of technologies including explainable AI, AI particularly effective for social infrastructure, AI operating on the edge side and AI regarding human beings.

○ We have developed solutions to optimize power plant operation by making full use of optimization and AI technologies. The solutions are used by power companies.

○ We have a solution to optimize railway and other transportation planning and use AI in this solution to develop a business that optimizes railway transportation planning.

○ In the area of energy, we use AI technology for dashboard construction, abnormality detection and failure prediction. We are conducting demonstration experiments in the customer's plant as well as in the company.

○ We provide IoT solutions for manufacturing. In digital twin that uses the data gathered in the solutions, use of AI is progressing for optimization of operation and abnormality detection.

○ In the image area, we use AI for transmission line inspection by drone, checking of the combustion state in incineration facilities, visual inspection in manufacturing, detection of defect signs in aluminum die casting, classification of images of semiconductor wafer defects and medical images.

○ In the area of prediction, abnormality detection and factor estimation, we are using AI for power demand estimation, productivity improvement of semiconductor production lines, analysis and optimization of work behavior in factory working areas, abnormality detection in water treatment and building interiors, and optimization of service parts stock.

○ There is a need to determine the number of people in a crowd (crowded conditions). With crowd measurement AI, it is possible to detect the number of people in a crowd from camera images with very high accuracy. By deploying this system at stations and downtown areas, various social implementations are being promoted by checking the crowd density information from time to time.

○ Remote work, online lessons and other online activities are rapidly progressing. Because many universities have introduced online activities, we deploy solutions to recognize the spoken words of lessons real-time and convert them to characters and are conducting demonstration experiments in remote work of universities.

○ We started a service to predict the risk of developing six lifestyle-related diseases (diabetes, hypertension, obesity, dyslipidemia, liver dysfunction, and renal dysfunction) from medical examination data. For example, by inputting one year of examination data, AI will show the risk percentage of developing diabetes for the next five years.

○ Human resources within the company are very important in promoting the use of AI. In order to create and realize human resource development plans as a group, an internal AI engineer training program was developed in collaboration with universities, and includes intensive and specialized AI education and training. This training is continuously implemented, and engineers who have never been exposed to AI before are now able to develop AI models and design systems by taking this course, which is being deployed internally.

○ In order to increase the scale of the business, we need to increase human resources for development on the business side and are therefore expanding practical education.

○ Academic theory of machine learning is not necessarily required for everyone. We focus on ability to use core engines provided through cloud and open source. Because there are various education courses and materials, we are developing human resources who may not understand the theory of machine learning and pattern recognition but can create business solutions by applying the technologies to actual problems.

○ It is difficult to employ people who can handle AI from the beginning not only in Japan but also globally. Because it is difficult to employ over one thousand people from the outside in order to increase our AI human resources to 2000, we intend to change other IT engineers of the company to AI human resources in most cases.

FUJIFILM: Regarding Fujifilm's AI development and application case studies and establishment of a basic AI policy

Summary of the key initiatives regarding AI development/utilization

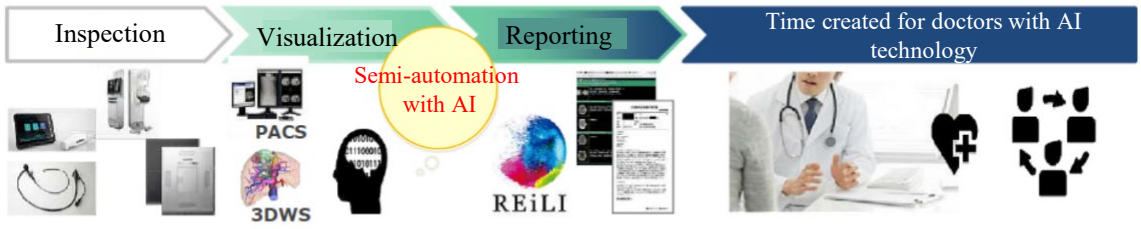
Initiative	Summary
Medical systems	Semi-automating the workflow of image diagnosis (support for recognition of anatomical structure, detection/measurement of lesions and report generation), reducing burden on doctors.
COVID-19 countermeasure	Improving access to diagnosis by using a small X-ray system in remote places of emerging counties and areas with shortages of doctors/hospitals (pneumonia detection is made possible)
Documents	Providing document services (digitalization, classification, etc.) to solve problems according to the characteristics of the industry and business
Imaging	Editing photo books by proposing image selection and layout that meet the user's preference

Summary of the key initiatives regarding AI ethics/governance

Category	Summary
Guidelines and principles	Formulating "Fujifilm Group AI Policy" in December 2020, recognizing the risks of human rights violations that could occur through the development/use of AI and the powerful influence of such occurrences.

Medical systems

Workflow using AI



Semi-automating workflow using AI technology to reduce burden on doctors

Fujifilm Group AI Policy

[Basic policy]

1. Accelerating New Value Creation
2. Respecting human rights
3. Appropriate use of Ai
4. Managing information security
5. Ensuring transparency
6. Developing human resources

■ Overview of the presentations/opinion exchanges at the hearings

○ The foundation of AI utilization in the medical field is the Picture Archiving and Communication System (PACS). Global spread of our PACS that is a platform for management, storage and sharing of data of CT, X-ray and ultrasonic images enabled wide and swift deployment of AI diagnosis systems.

○ Putting an AI diagnostic platform on PACS to semi automate the workflow of doctors. By using AI to semi automate the four step workflow of "visualization," "detection," "classification" and "reporting" after an examination, the goa l is to reduce the burden on doctors so that they can spend more time on patient care and other tasks.

○ AI is not yet at the level of diagnosing all diseases, but instead detects specific disease based on X-ray, ultrasonic and endoscope images. Currently we are developing technologies of COVID-19 AI image diagnosis support.

○ Under certain conditions, diagnostic imaging AI can have higher detection rates than medical specialists. However, instead of letting AI make decisions, it is positioned in a support role for doctors. The product incorporates a device that does not disrupt the relationship between the doctor's diagnosis and the AI diagnosis to confirm the results.

○ In order to conduct COVID-19 diagnosis in remote places of emerging counties and areas with a shortage of doctors/hospitals, we used small X-ray devices equipped with AI. In back regions where large X-ray cars cannot enter and areas without power sources, we can use a small rechargeable X-ray device to make mapping and diagnose pneumonia. By conducting the PCR test only when pneumonia was diagnosed, we enabled labor- and time-saving COVID-19 diagnosis in remote places.

○ The "AI Basic Policy of Fujifilm Group" was established in December 2020. First, it was recognized in the company that discussions on formulation of rules of AI development and utilization are advancing in forums, conferences, governments, ICT and other companies. In FY2020, when the ESG department carried out human right due diligence (inspection of the risk of violation of human rights), the company recognized possible risk of infringement of human rights in AI development and utilization, and a big impact if the risk surfaced. At that time, the ICT department that was conducting development while paying attention to the bias of teaching data was worried about the lack of stipulation. To address the situation, the two departments started to formulate a policy in cooperation.

○ Steps toward the establishment were: (i) sorting out the AI development/use situation in the company and identifying possible risk of AI violating human rights; (ii) checking the trends of general principles of AI, which include trends in Europe, the United States, China and OECD, "Principles of Human-centric AI society" of the entire government, "Draft AI R&D Guidelines for International Discussions" and "AI Utilization Guidelines" of the Promotion Council and AI policies of other companies in Japan; (iii) drawing up the company policy based on mutual recognition on possible risks in the company with departments conducting AI development/utilization, and; (iv) establishing the policy with the approval at the ESG Committee and the Board of Directors.

○ The focus of this policy was to avoid restricting t h e development and utilization of AI more than necessary. The purpose of utilizing AI is to improve social benefits and solve social issues, and, in this process, the basic stance has been to respond appropriately to problems that may arise. Another purpose is for data providers to read the basic AI policy, rely on and trust the company, and entrust their data with a sense of security. This policy will be reviewed periodically, and the content will be revised to reflect changes.

○ For the future, we think we need to make specific rules for individual divisions because people in job sites cannot know what to do with policy alone. In addition, we recognize the need for a mechanism of

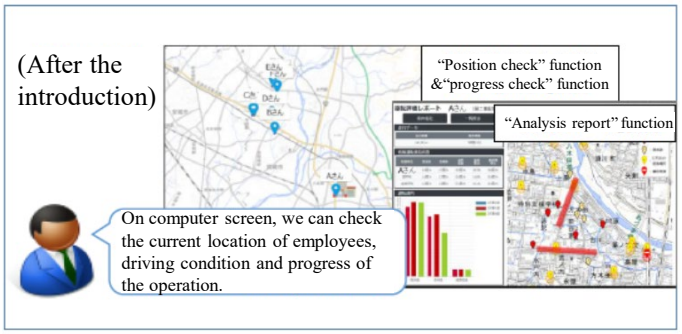
independent verification in order to guarantee objectivity. Examination items are yet to be established, but we will develop a mechanism in due order. Furthermore, because the issue is actively discussed internationally, we will watch the trend and update the mechanism appropriately to lead the company.

Japan Post: Efforts to utilize technology in the postal and logistics fields

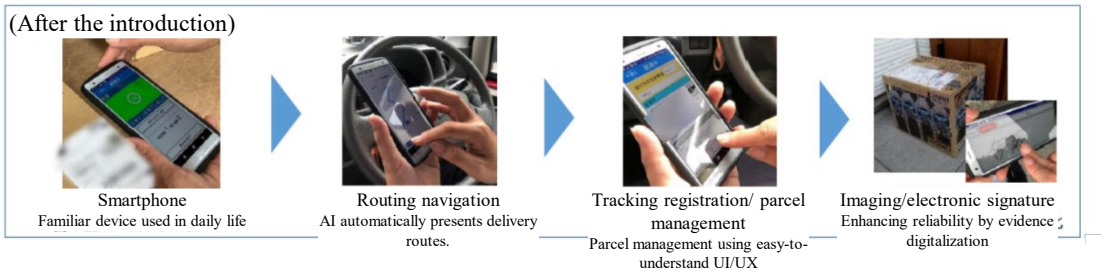
Summary of the key initiatives regarding AI development/utilization

Initiative	Summary
Telematics	We visualize delivery operations by obtaining location data from motorcycle deliverers carrying smartphone terminals. Obtained data is used to review delivery zones and routes in order to improve operation efficiency.
Automated routing system	Introducing digital technologies including smartphone routing in our parcel delivery service to realize a system that reduces burden of delivery work while at the same time making delivery easy even for inexperienced employees.
Robotics	Demonstrating automation and manpower saving by using robots in internal operations including transportation of shipment containers and placing parcels in the sorter.
AI call center	Using AI voice recognition to automate responses to requests for redelivery to homes at the call center that receives redelivery requests.
Sophistication of delivery (drones, delivery robots, autonomous cars)	Demonstrating utilization of drones, delivery robots, autonomous cars, etc. to improve efficiency of transportation.

Telematics



Automated routing system



Sophistication of delivery

■Drone
ACSL PF-2

■Delivery robot (outdoor)
ZMP DeliRo

■Delivery robot (indoor)
RICE

■ Overview of the presentations/opinion exchanges at the hearings

○ We are investing the most resources in delivery operations, especially in mail delivery using motorcycles. We apply mail telematics to this area and are improving efficiency using the technology in cooperation with manufacturers. Specifically, we visualize delivery operation for operational management and employee training by having deliverers carry smartphones and plotting their location. For the future, we will consider cost reduction while introducing demand forecasts.

○ Unlike mail delivery, parcel delivery routes change every day because there are days without parcels to deliver in some area. Delivery routes have been organized with the skill and intuition of experts. For the future, considering that it will become difficult to secure experts, we are working to shift to a system that uses routing technology to reduce the burden of delivery work while at the same time making delivery easy even for inexperienced employees.

○ Because lifestyles of addresses are increasingly diverse, we want to deliver parcels according to different lifestyles. In particular, we aim to avoid delivery in absence by understanding the tendency (in or out) of the addresses by using past delivery data with due consideration to protection of personal information.

○ Redeliveries have a big negative impact also in terms of environmental burden. We are making efforts to eliminate redelivery.

○ Our challenges include inventory control on the supply chain to reduce total workload through optimal inventory allocation based on demand forecasts in cooperation with business operators opening stores in EC malls.

○ In sorting facilities as well, we depend on manpower for feeding and removing parcels to and from transporting machines. We want to use mechanization and automation technologies here.

○ Call centers receive a great number of requests for redelivery, etc. and the primary response is made by AI. At the initial stage of introduction, AI handles requests for typical redelivery to homes. Gradually we will expand the system to reception at post offices and requests for collection.

○ We are attempting sophistication of delivery using drones and delivery robots and experimenting with delivery by drone to a solitary house in the middle of a mountain, or delivery/collection by delivery robots on public roads of the city center, for example. We hope to advance implementation step by step also for indoor logistics in high-rise condominiums and large commercial facilities.

○ Delivery by drones in public areas requires government approval for each route. Because the route changes every day according to the need for delivery, we feel that it is difficult to actually develop the service. As rules and guidelines are being developed, we will watch the trend.

In order to gain understanding at the neighborhood level, we are conducting grass-root activities including asking for agreement by presidents of the neighborhood associations, but we need to pursue consensus building.

○ Safety is important when a delivery robot moves on a public road, where people with disabilities, small children, the elderly, or bicycles may be moving. We will promote the initiative while studying what measures to take to prevent collisions, and by watching the state of rule development.

○ Address information particularly requires privacy protection and has been used only for mail operation, but we think it can be used for disaster prevention resilience and safety confirmation with due consideration to privacy. Demonstration experiments are conducted on delivery according to lifestyle by using data from smart meters. It is important to develop a strategy on data holding and utilization to combine privacy protection and data utilization.

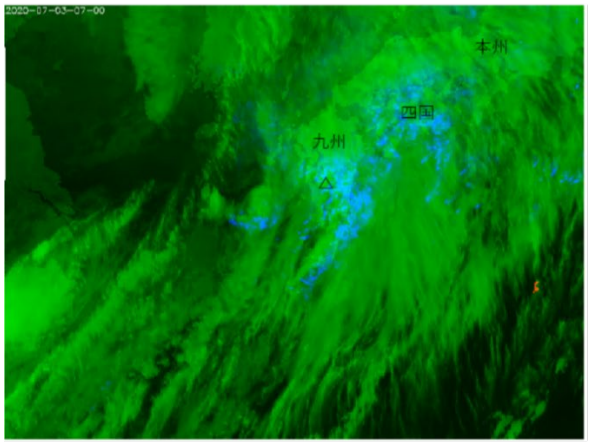
Stella Place: Development of the AI weather prediction model in high-performance computing and the possibility of its application at the PC level

Summary of the key initiatives regarding AI development/utilization

Initiative	Summary
AI weather forecasting	Predicting weather conditions based on images of weather radars For the future we hope to contribute to disaster prevention/mitigation by displaying charts on mobile phones during outdoor traveling, providing forecasts when radars have stopped due to a disaster, or when the wired network is down due to power outage, for example.

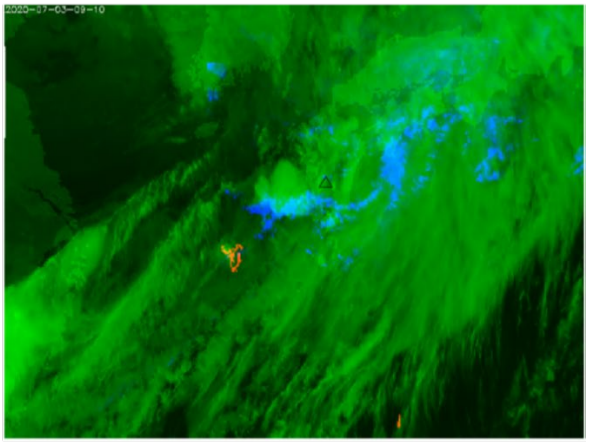
AI weather forecasting

(Training in Kyushu)



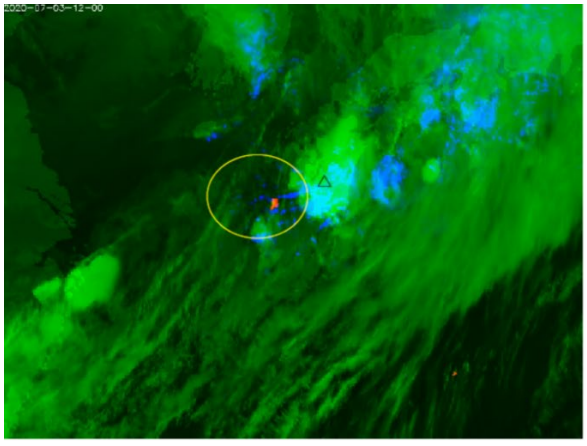
2020/7/3 16:00

The Kumagawa River started to rise. The location of Hitoyoshi city is indicated by a black triangle.



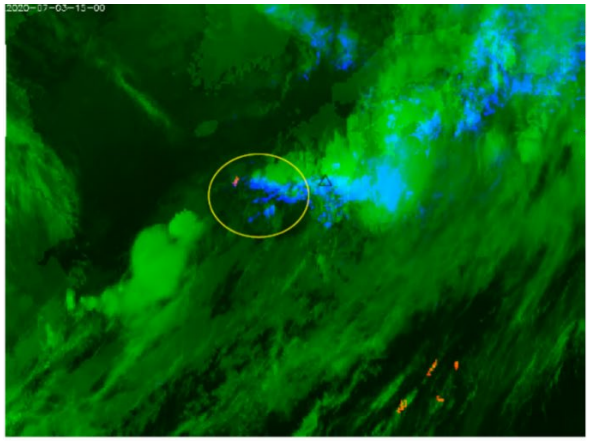
2020/7/3 18:10

Clouds rapidly developed over the sea in the west of Kyushu (shown in red).



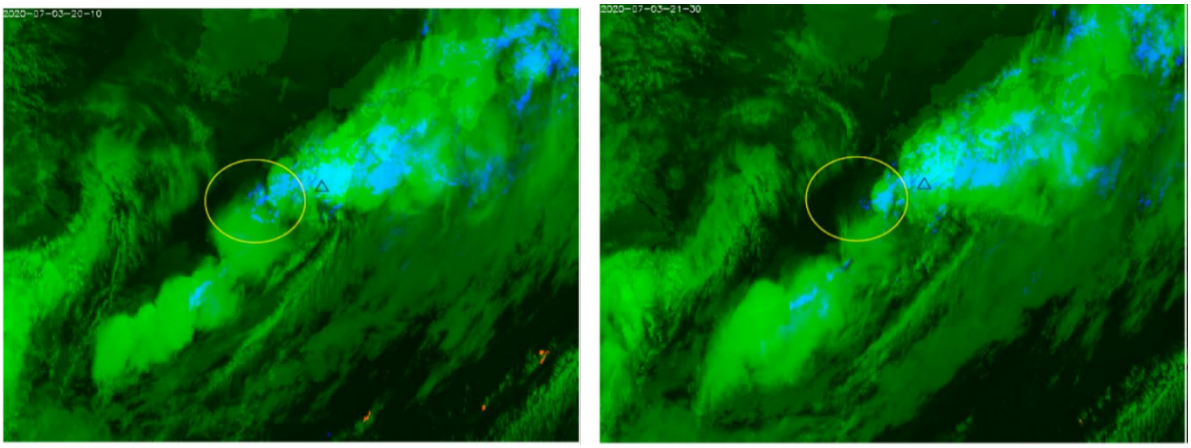
2020/7/3 21:00

Clouds rapidly developed over the sea in the west of Kyushu. Later, rapid development of clouds (shown in red) was detected intermittently in the area that is shown by a yellow ellipse.



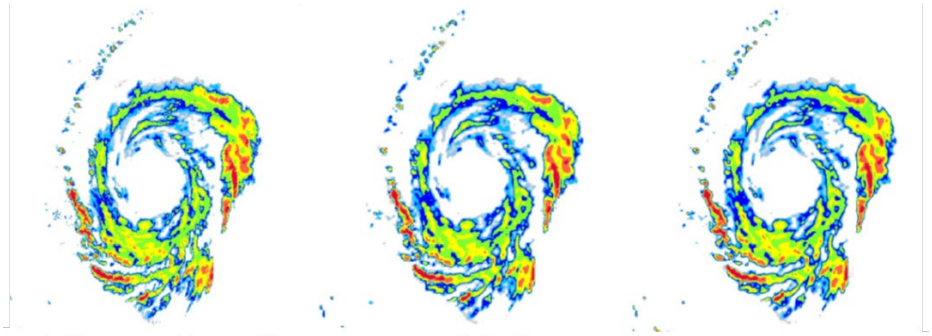
2020/7/4 0:00

Around this time, rainfall rapidly increased near Hitoyoshi city.



2020/7/4 5:10　　2020/7/4 6:30

Five minutes later, Hitoyoshi city issued an evacuation order.



Real radar image　Primary processing by AI　Final AI model processing

■ Outline of the presentations/opinion exchanges at the hearings

○ Weather disasters cause huge losses. Hoping to contribute to society through prediction of weather disasters by using various technologies, we reproduced a weather model using AI. Based on weather radar images, we calculated expected movements including cloud shape and wind direction, and made corrections while comparing data of the past three years and future predictions to create the model.

○ For example, typhoons usually travel from west to east, but Typhoon No.19 in 2019 moved from east to west. This is a rare phenomenon that occurs once in a half century. It was difficult to predict its movement in ordinary ways, but the AI model could predict the movement several hours before.

○ We added up satellite information and radar information while comparing them numerically using a specific calculation method. In this way we followed physical phenomena alone in a manner faithful to the system by looking at how figures captured from meteorological satellites are expressed as a cloud and how they move, and thus developed an AI model based on numerical values alone rather than images. We ask weather forecasters to review the images processed by this AI model and are working to improve the model while getting input from weather specialists.

○ People in the West ask: 'Why are we creating virtual radar in Japan when we have real radars?'. However, radars may stop due to a huge typhoon, and guerrilla rainstorms and training due to climate change are difficult to catch by radars alone.

○ Because the model can be used based on the chip performance of mobile phones, in the future it will be possible to see weather prediction charts at hand in various situations including: when radars stopped due to a typhoon, when the wired network is down due to power outage, when the main server is down and during outdoor traveling.

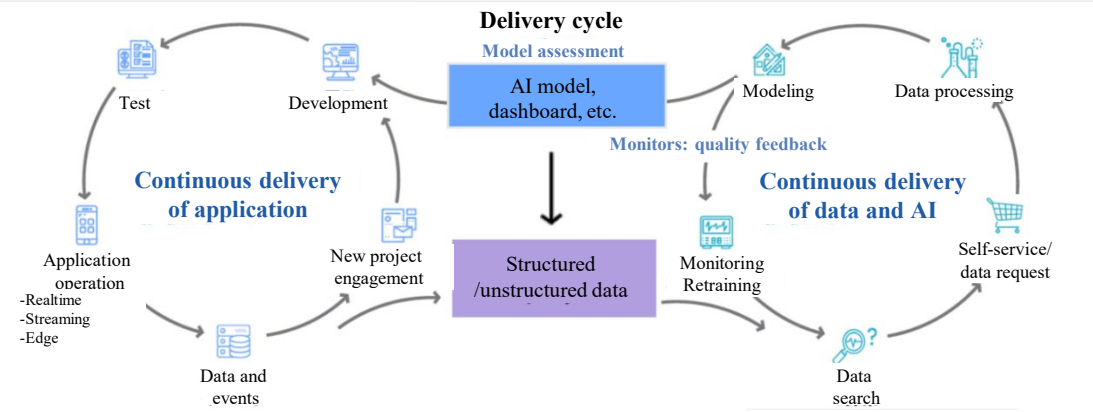
At present, we are conducting operation tests of prediction eight hour ahead, but it will be socially useful when it can predict further ahead.

IBM Japan: IBM Data and AI technologies to support enterprise-wide AI adoption

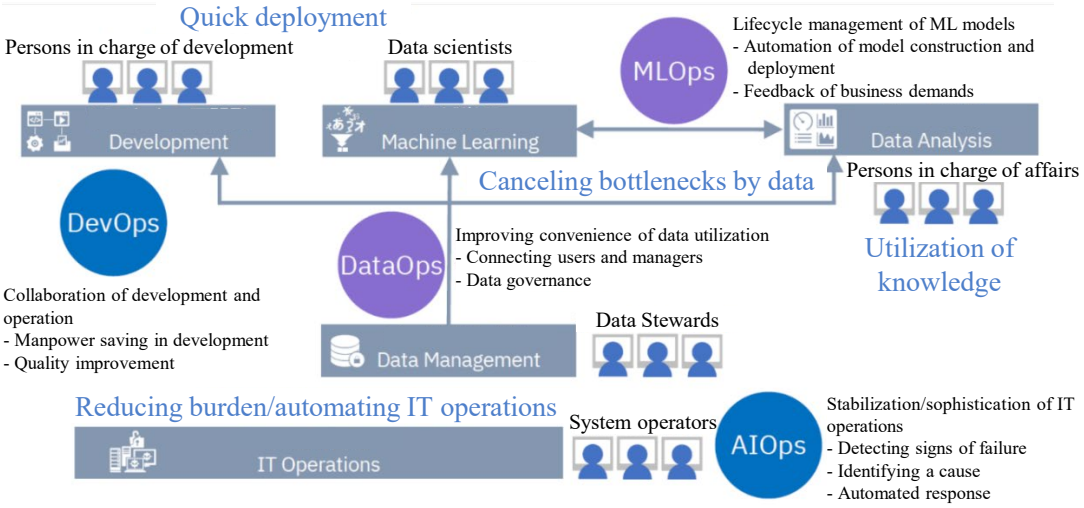
Summary of the key initiatives regarding AI ethics/governance

Category	Summary
Guidelines and principles	Releasing “IBM’s Principles for Trust and Transparency” in May2018. Releasing “Everyday Ethics for Artificial Intelligence” in September 2018.
Development review	Constructing two delivery models: “continuous delivery of application” and “continuous delivery of data and AI”, conducting model assessment and quality feedback.
Fairness	Automatically assessing the fairness of the models when executing operation, notifying models with bias and suggesting initiatives to reduce the bias.
Transparency and accountability	Monitoring performance of AI used for business application and explaining AI outputs and recommendations in business terms. Providing traceability and auditability of predictions by AI.

Two continuous delivery models



System for quick response to changes



■ Overview of the key initiatives regarding AI development/utilization

○ The environment of digital business is changing dynamically every day. In the dynamically changing society, companies are required not only to produce products but also to have intelligence, resilience and flexibility for continuous operation of the products. We are working on new products with focus on these areas.

○ The purpose of delivering AI technologies is changing. We need to provide supports for customers to increase their business value through utilization of AI. Beyond delivering prediction, automation, optimization and other technologies, we have changed our method of providing technologies and services with the main purpose of providing value for the customers' business as a result of the delivery.

○ From the perspective of making an impact on business, it is important to expand AI across the company to lead to practical use. For this purpose, we need to solve the customers' challenges concerning AI. 3 Key challenges are data, human resources and trust.

○ With regard to trust, the past focus was on improving the precision of prediction. Today fairness and explainability are also required. Through dialogs with customers, we strongly feel that companies are required to conduct explainability and accountability.

○ In order to monitor the fairness and performance of the model, rather than monitoring the model during the development phase to detect bias, we are building a mechanism using technology that monitors the AI model during the execution of the operations to detect the occurrence of bias or data drift and to encourage rectification if needed.

○ AI utilization does not end by technology development for one use case. In order to use AI in actual business, it is necessary to construct a structure for data management and AI management and utilization in the company. It is necessary to construct an "AI ladder" consisting of roughly four steps and develop and operate AI in accordance with the structure.

○ Rather than just creating a one-time application, a cycle of growth is being established by incorporating new requirements frequently. In this cycle, new applications generate new data. It is necessary to continuously develop the AI model using newly generated data, and it is important to operate the two continuous delivery cycles of "continuous delivery of applications" and "continuous delivery of data and AI" in both directions.

○ We think that the present realistic solution is to support users while taking advantage of AI technology rather than automating the entire delivery cycle, because doing the entire cycle manually would take man-hours, time and costs.

○ "Continued delivery of data and AI" is a cycle of trials on what kind of data to use to develop what kind of applications and AI solutions. The environment for these trials does not require a very high service level. However, when applying a model promising a certain accuracy to actual services, a very high service level is required for the runtime environment of the AI model used for the actual operation and deployment environment. It is important to separate the service level of the two types of environments.

○ Users of AI tend to be limited due to the difficulty of the technologies used. However, we think that our purpose is not application of AI technology itself, but increase of business value through the utilization.

○ In Japan, unlike in the United States, client companies do not employ a large number of data scientists. For this reason, we support clients by providing service for human resource development in addition to tools and systems. In addition to data scientists, we also help establishment of a team of people who manage data governance in the client company.

Hitachi: Efforts toward the realization of an AI network society

Summary of the key initiatives regarding AI ethics/governance

Category	Summary
Guidelines and principles	While formulating "Principles for the Ethical Use of AI" in February 2021, we published our white paper in and outside the company to state our behavior standards and practice items in each phase of planning, social implementation and maintenance/management.
Organization and structure	We set up a team specialized in AI ethics, which cooperates with the AI ethics advisory board consisting of external experts and the internal privacy protection committee, while at the same time promoting in-company training.
Development review	Developing "AI application framework" for speedy social implementation of the latest research results based on the Principles for the Ethical Use of AI. Providing new solutions by learning models, accumulating the results in a database and reintegrating them for each purpose.
Human resource development	Practicing AI ethics through classroom lectures for new recruits and establishing learning by risk prediction training through workplace discussions. Gathering top data scientists to "Kyōsō-no-Mori" of the Central Research Laboratory. Constructing a cycle of spiral up of R&D and business by gathering data utilization technologies and knowhow. Establishing a system to authorize data scientists.

Summary of the key initiatives regarding AI development/utilization

Initiative	Summary
IT	Housing loan examination, insurance service
Mobility	Visualization of people flow and behavior, Dynamic Headway (optimization of operation plan)
Industry	Industrial solution (overall optimization), advanced factory (value chain optimization), failure sign diagnosis, worker action deviation detection
Life	Biomarker search, abnormality detection and accuracy improvement of analyzing equipment
New company that maximizes Happiness	Establishing "Happiness Planet Ltd." in August 2020

■ Outline of the presentations/opinion exchanges at the hearings

○ In February 2021, the “AI Ethical Principles” were formulated and a white paper was released to the public. Since Hitachi is responsible for building social infrastructures that contribute to the realization of a better society, action standards and practical items unique to Hitachi have been established, including the phases of planning, social implementation, and maintenance management. We started application of the “Principles for the Ethical Use of AI”, while at the same time promoting education. Over 100 employees participate in AI ethics education and discussions. For practice of AI ethics, we implement regular introductory education, establishment training, screening and discussions in our global R&D groups.

○ We organized a team specialized in AI ethics that promotes in-company training for individual sectors in cooperation with an AI ethics advisory board consisting of external experts and an internal advisory committee on privacy protection.

○ It is important to improve our sense of human-centered ethics perspective through discussions with external experts. We discuss AI ethics in regular meetings of company-wide subcommittees including business departments and laboratories. Several times a year we invite external experts for wide-ranging and honest opinion exchange on how AI is recognized in society and what requires attention. Through these activities we raise our sensitivity in conducting R&D, social implementation and utilization.

○ The team specialized in AI ethics is a group of experts with technical backgrounds and belongs to Lumada Data Science Lab (top group of data scientists). Because R&D and social implementation of safe, secure and trustworthy AI requires people with various backgrounds, the team also includes researchers of design and social psychology.

○ We manage behaviors of AI models by providing development/operation support infrastructure also after starting actual operation of AI systems. We continuously monitor input data and results based on the rules set beforehand. When there is an abnormal data or result, degradation of prediction accuracy of the AI is prevented through automatic detection. We conduct R&D under this scheme based on the AI ethics principles to promote swift social implementation of the latest research results, while at the same time working for appropriate operation and quality assurance.

○ We provide image analysis that visualizes the flow and behavior of people for the safety and security of

public space. By displaying persons as icons, we ensure privacy protection in this service. The system that visualizes and distributes congestion information real-time enables checking of the degree of congestion by smartphone/tablet and can be used to counter COVID-19.

○ Since fair judgment is required for the application of AI for mortgage screening, Explainable AI (XAI) is used to explain the basis for the decision. By using this XAI to provide the basis for the decision, both the reviewer and the reviewee can use the AI with confidence.

○ We established Lumada Data Science Lab that unifies the business division and R&D. By combining consulting and proposal adaptation capabilities of the business side with the AI technology of the R&D side, the lab has already received several orders.

○ Regarding the training of data scientists, we have divided scientists into three tiers Gold, Silver, and Bronze and are working toward improving their levels and developing digital transformation human resources (3,000 people in total). The Gold level consists of top data scientists who tackle advanced is sue s and create new methods; open innovation is actively used to hone technology and people. The Silver level consists of leaders in the data analysis business of each business unit; people from internal business units are accepted and trained through OJT. The Bronze level consists of people responsible for data analysis practices, leveraging a development program created by Lumada Data Science Lab. to provide opportunities for skill improvement

○ For ethics of engineers, it is important to foster culture. The top management takes the initiative to establish high ethical standards through self-improvement at Hitachi Professional Engineers Association and education of young people. We also established a new company to maximize happiness through AI.

Conclusion

This report overviewed the domestic and overseas trends and international discussions with focus on AI ethics and governance. While looking at AI utilization to counter COVID-19 in the light of the continuing spread of COVID-19, we also attempted to make international comparison of AI utilization. In addition, while introducing initiatives for implementation of AI in society as gathered through hearings of stakeholders, the report also summarized future initiatives.

As mentioned in Chapter 1, various initiatives regarding AI are implemented in Japan and abroad and international discussions are ongoing at OECD, GPAI and other forums. It is important to continue to contribute to international discussions while following domestic and overseas trends. The "Proposal for a Regulation laying down harmonized rules on artificial intelligence" published by the European Commission in April 2021 can make a big impact also on Japan. This requires close attention and necessary responses.

Chapter 2 described COVID-19 and AI utilization. With the infection is still spreading, it is considered that AI can fulfill a significant role in addressing COVID-19. We expect development and utilization of AI that are effective and useful as COVID-19 countermeasures including the shift to a new normal in the future. Through the international comparison, we identified a challenge of finding the appropriate balance between improvement/extension of public health and privacy protection. It is important to implement initiatives that can gain the understanding of citizens in consideration of the conditions of other countries and regions.

In Chapter 3, we conducted hearings, etc. of researchers and business operators who are making advanced or ambitious efforts to implement AI in society and compiled a large number of practical examples regarding implementation of AI in society. It is thought that this document with so many practical examples is unprecedented and will provide very useful and helpful information. We again thank the researchers and business operators who cooperated with the hearing and hope that the examples will be widely shared by people who are tackling or considering tackling AI R&D/utilization, which will promote implementation of AI in society.

The AI R&D Guidelines and the AI Utilization Guidelines compiled by the Promotion Council hold out the basic principle: "To achieve a human-centered society where all human beings across all of society enjoy the benefits while in harmony with AI networks, and human dignity and individual autonomy are respected."

Achieving a human-centered society is a challenge shared by all human beings. It is important to take actions for safe and secure utilization of AI under appropriate conditions by everyone with the aim of creating an inclusive and sustainable human-centered society, which includes AI utilization as a COVID-19 countermeasure. It is also important to form a global network of "knowledge" and jointly create "knowledge" to solve problems common to all human beings.

Based on the above, the Promotion Council will continue to promote "Safe, Secure, and Trustworthy Implementation of AI in Society" by multi-stakeholders, while actively providing information to the international community.