Analysis on Prospect of Ecosystem Formed with Progress of AI Network
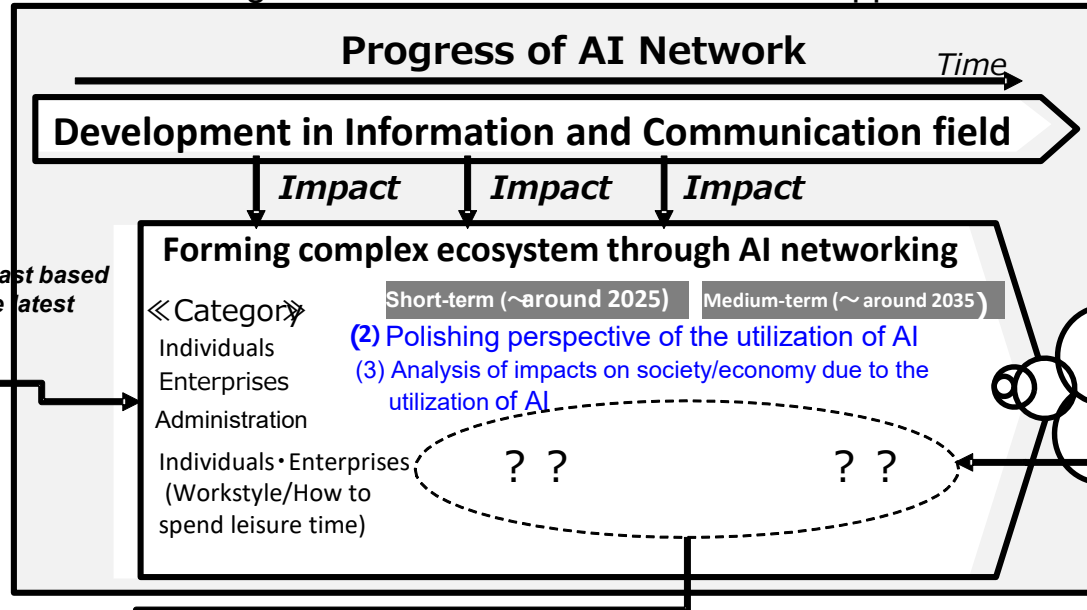
■ Objectives

- Objective as a base for the discussion for the promotion of the implementation of AI in society
- Objective as a base for the policy consideration in the Committee on AI Economy

■ Contents

(1) Analysis of the survey of the latest trend of the utilization status of AI

(2) Polishing perspective of the utilization of AI

(3) Analysis of impacts on society/economy due to the utilization of AI

(4) Case studies on the implementation of AI in society

Image of the entire tasks and backcast approaches

Progress of AI Network

Time

Development in Information and Communication field

Impact   *Impact*   *Impact*

Forming complex ecosystem through AI networking

Forecast based on the latest trend

≪Category≫

Individuals

Enterprises

Administration

Individuals・Enterprises
(Workstyle/How to
spend leisure time)

Short-term (～around 2025)   Medium-term (～ around 2035)

(2) Polishing perspective of the utilization of AI

(3) Analysis of impacts on society/economy due to the
utilization of AI

？？   ？？

(1) Analysis of the survey of the
latest trend of the utilization
status of AI
⇒   Existing reports
(future forecast)

Backcast based on complex ecosystem

≪Cases ≫

Transfer
Health
Finance
Crisis management
Manufacturing
Residential
Energy

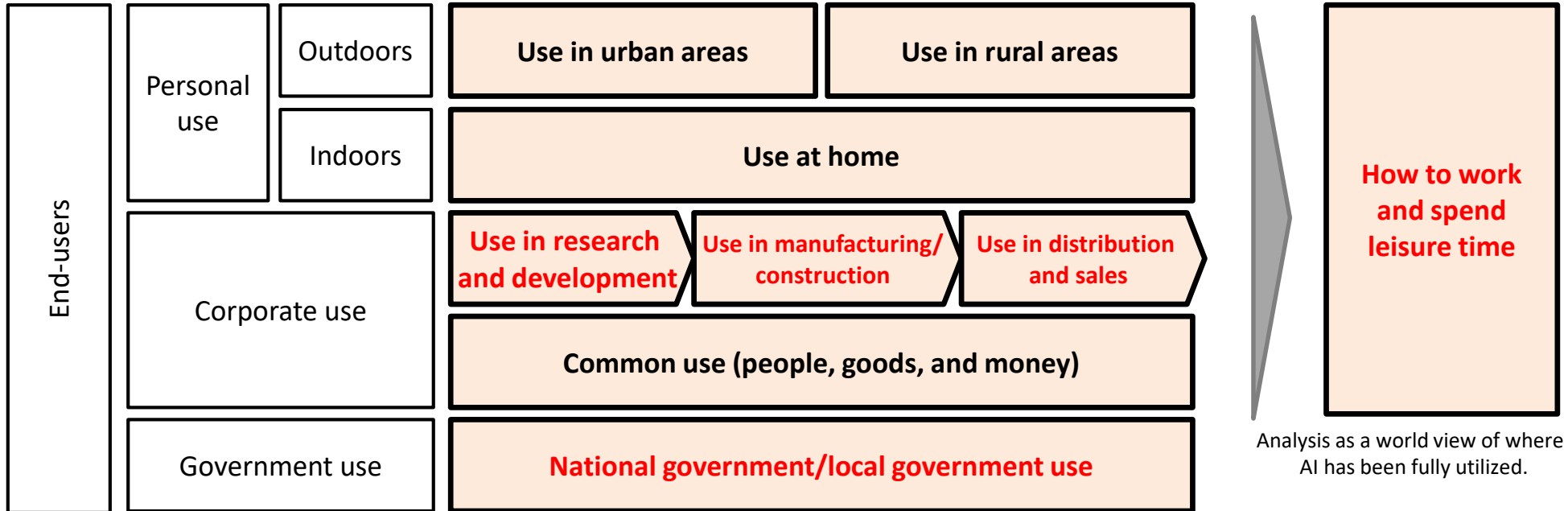|	(Social)	(Economic)	(Legally)	(Technically)
Benefits	？？	？？	Not covered	
Issues	？？	？？	？？	？？

(4) Case studies on the implementation of AI in society

Analysis Policy on Perspective of the Utilization of AI

(Corresponding to (2), (3))

1) [Attachment 3-1] Focusing on the AI utilization and **looking at the scene of the AI utilization** in terms of both consumers and businesses. In the perspective of AI utilization, the utilization scenes are classified as follows:

<Classification of AI utilization scenes>

End-users	**Personal use**	Outdoors	Use in urban areas / Use in rural areas
		Indoors	Use at home
	Corporate use		Use in research and development / Use in manufacturing/construction / Use in distribution and sales
			Common use (people, goods, and money)
	Government use		National government/local government use

How to work and spend leisure time

Analysis as a world view of where AI has been fully utilized.

(Prepared based on Attachment 2 "Prospect of Ecosystem Formed with Progress of AI Network" of the Conference toward AI Network Society 2018 Report. The red letters are the parts added to 2018 Report.)

(Corresponding to (4))

2) [Attachment 3-2] Based on the the utilization scenes the above mentioned 1), **case studies on implementation of AI in society** were conducted, and the benefits and issues were pointed out.

Case: Transfer (fully autonomous driving)
Case: Health (medical care/nursing)
Case: Finance

Case: Crisis management (crime prevention, public infrastructure, and disaster prevention))
Case: Manufacturing
Case: Residential
Case: Energy

Contents of implementation of analysis

Contents of research [Corresponding to contents of implementation (1)]

Contents of analysis (output)
[Corresponding to contents of implementation (2) (3)]

AI related roadmaps

Apps that utilize AI

Benefits and issues in the utilization of AI

(1) Perspective of the utilization of AI
◆ Examine the status of realization of utilization scenes published on the past reports, referring to roadmaps, etc.
◆ Based on the latest utilization application of AI, review the utilization scenes to be published in line with the following policies.
➤ **Extract utilization scenes of various realization time (Review in the viewpoints of forecast and backcast)**
➤ **Extract utilization scenes related to attention-grabbing keywords**

[Corresponding to contents of implementation (4)]

(2) case studies on the implementation of AI in society
◆ Extract the benefits and issues characteristic of each case, based on the research results of benefits and issues brought about by the utilization of AI

Regarding technology and its progress in society, the utilization scenes of AI and case studies were polished, digging deep into various books and news articles for supplementation based on the AI-related roadmap/strategies in the government.

■ Information source (1): AI related (Partial)

Classification		発表元	Roadmaps/Strategies, etc.	Announced date
Entire domains		Cabinet Office	AI Strategies 2019	Jun. 2019
		NEDO	Roadmap of R&D Goals of AI and Industrialization	Mar. 2017
		MIC	Subcommittee for Making the Future of the IoT New Era, Tech Strategies to Catch the Future	Aug. 2018
		MIC	Interim Report from Information and Communication Council in response to Inquiry about Ideal State of New Information and Communications Policies for the IoT and Big Data Era (No. 23 of 2015)	Jul. 2017
		MIC	Interim Report from Information and Communication Council in response to Inquiry about Ideal State of New Information and Communications Policies for the IoT and Big Data Era (No. 23 of 2015)	Jul. 2016
		MIC	Roadmap of Promotion of Implementation of Regional IoT (Revised）	Apr. 2018
		MEXT	The Vision of Future in society through the development in Science and Technology	Nov. 2019
Domain of individuals	Administration	MIC	Standardization in the operating process/system in local governments and Society on Utilization of AI/Robotics (Smart Local Government Society）	May 2019
	Medical care/ Nursing	MHLW	AI Development Acceleration Consortium in Health/Medical Care Field Document Reference 3 Arrangement of AI Development Acceleration Consortium in Health/Medical Care Field Discussion and Future Directivity and Future Directivity"	Mar. 2019
	Healthcare	METI	Future Ideal Medical Care/Welfare/Nursing Fields in 2040 and survey on formulating the roadmap, etc.	Oct. 2019
	Transfer	Cabinet Office	ITS Concept for Public and Private Sectors/Roadmap 2019	Jun. 2019
	Manufacturing	METI	Smart Factory Roadmap	May 2017
	Construction	MLIT	The Study Group for preparing the establishment of AI Development Support Platform	Aug. 2019

■ Information source (2): Books and news articles, etc.

They were utilized for dig deep or supplements, etc. of the utilization scenes provided in Roadmap/Strategies, etc.

① Perspective of the utilization of AI

(Note) The perspective of the future utilization of AI is described here even if the realization is expected to be difficult on the premise that the laws and technologies and researches available in practical application at the moment are used. In addition, economic costs, etc. need to be considered in practical application.

- **Timing of Implementation of**
- **utilization scenes**
  - ➢ Should be a timing when it's launched without considering the spread of services and fullness of functions.
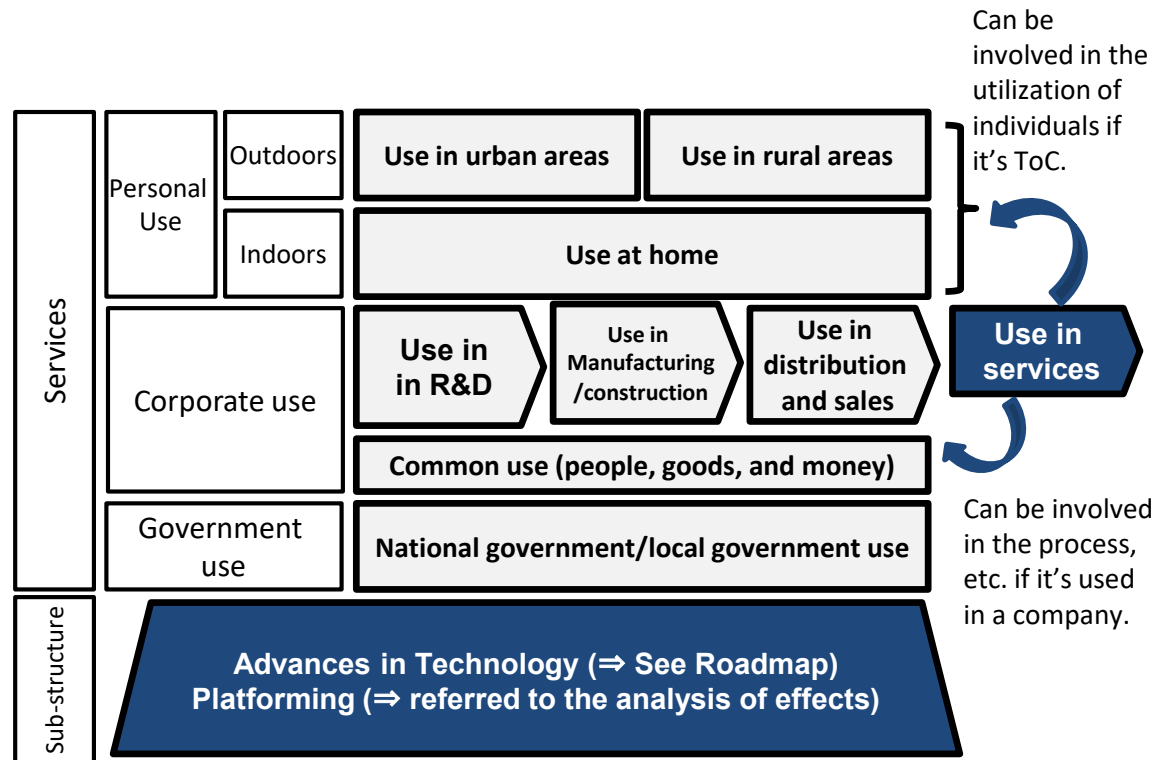
- **Positioning the utilization of AI in the provision of services**
  - ➢ Services for individuals can be involved in the utilization of individuals
  - ➢ In case AI is utilized in a corporation to provide services, it will be involved in the process or common.

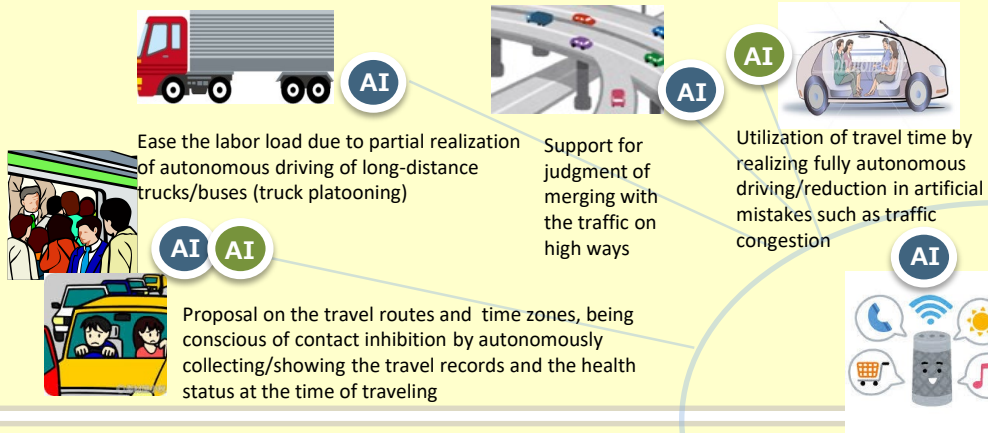- **Analysis of the sub-structure**
  - ➢ Position the advance of technology and platforming as the sub-structure of services
  - ➢ Advance of technology is considered by extracting the utilization scenes, referring to the roadmap, etc.
  - ➢ Changes in business models (platforming), etc., will be explained in the part of analysis of effects, not in the part of the utilization scenes.

AI What has already been put to practical use/ Things that are likely to be realized shortly (by around 2025)

AI Medium term (up to around 2035)

Can be involved in the utilization of individuals if it's ToC.

Can be involved in the process, etc. if it's used in a company.

Services					
	Personal Use	Outdoors	Use in urban areas	Use in rural areas	
		Indoors	Use at home		
	Corporate use		Use in in R&D	Use in Manufacturing /construction	Use in distribution and sales
			Common use (people, goods, and money)		
	Government use		National government/local government use		

Use in services

Sub-structure

Advances in Technology (⇒ See Roadmap)
Platforming (⇒ referred to the analysis of effects)
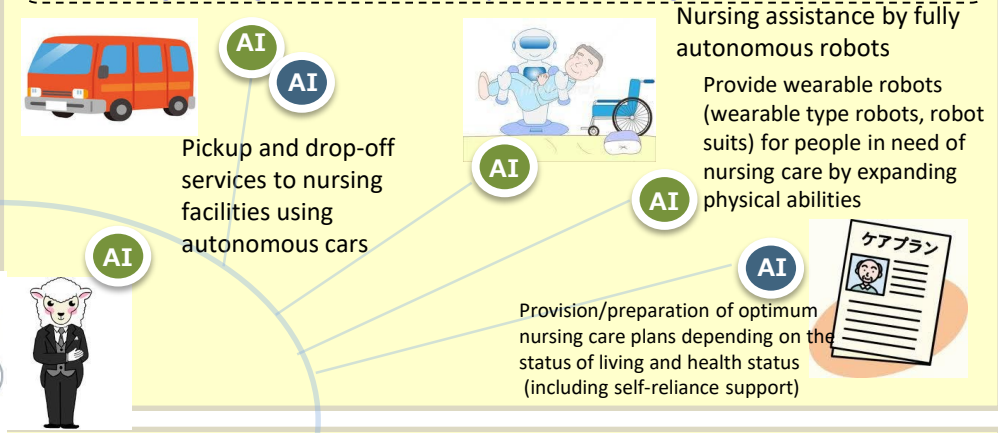
Transfer

MaaS: Mobility as a Service

- **The flexibility of transfer and the convenience will be remarkably improved due to MaaS, and the effective utilization of travel time can be accomplished due to the realization of fully autonomous driving.**

Ease the labor load due to partial realization of autonomous driving of long-distance trucks/buses (truck platooning)

Support for judgment of merging with the traffic on high ways

Utilization of travel time by realizing fully autonomous driving/reduction in artificial mistakes such as traffic congestion

Proposal on the travel routes and time zones, being conscious of contact inhibition by autonomously collecting/showing the travel records and the health status at the time of traveling

Nursing

- **Providing self-reliance support depending on the status of living and health status and pickup and drop-off services, using autonomous cars and utilizing nursing robots can make up for the shortage of labor.**

Nursing assistance by fully autonomous robots

Pickup and drop-off services to nursing facilities using autonomous cars

Provide wearable robots (wearable type robots, robot suits) for people in need of nursing care by expanding physical abilities

Provision/preparation of optimum nursing care plans depending on the status of living and health status (including self-reliance support)

Dialogue with AI speakers (Life/self-reliance support)
Utilization of butler robots

Proposal for travel plans according to travel records in the past, hobbies/tastes, and implementation of procedures

Simulated experiences of history linked to the VR/AR according to hobbies/tastes

All the itinerary from going out to coming home can be concluded empty-handed (can be concluded with face authentication

Facilitate communication with foreigners through multilingual translation

Implement effective remote education through data diet using AI in a limited communication band

Provision of learning contents according to your own capability, aptitude, etc. in collaboration with study at schools, cram schools, and home (necessary learning can be carried out regardless of places and grades)

Support for reemployment after retirement and support for lifelong learning

Provision of optimum contents for learning skills (including the know-how of skilled people and inheritance of intelligence)

- **As soon as you plan optimum trips, travel tickets will be automatically prepared and you can enjoy sightseeing without any trouble with baggage or languages through face authentication and translation.**

- **Optimum learning contents can be provided as well as optimum contents to learn skills required for learning necessary skills in cooperation with schools, cram schools and homes.**

Tourism/Travel

VR: Virtual Reality
AR: Augmented Reality

Education/Fostering HR

AI What has already been put to practical use/ Things that are likely to be realized shortly (by around 2025)

AI Medium term (up to around 2035)

(Note) Some examples of expected utilization are described. Examples are described with a view to the possibility of utilization without assuming the current system.

Transfer

- **Means of transportation for seniors' going to a hospital or shopping can be secured by the realization of autonomous driving, etc. and the transportation network such as route buses can be maintained.**

Resolve the problem of the shortage of bus drivers by adopting fully autonomous driving of fixed route buses

Realization of Fully autonomous driving cars and walking support robots will enable seniors, etc. to go out easily. (Securing means of transportation)

Secure a traveling method without depending on the infrastructure by using a flying car

Automatic transportation of baggage for shopping refugees by delivery drones, provision of unmanned transfer-type automated supermarkets

Medical care

- **Diagnosis by remote medical care or prognosis by robots, etc. can be possible in the areas where there are not specialty doctors. AI/robots can cope with the shortage of human resources such as medical care/nursing caregivers.**

Remote medical examination through medical images.

Matching with specialty doctors in emergency transport through adjustment among AI systems, Setting of optimum routes

Prevention and medical treatment considering the differences between individuals based on DNA analysis

Give first aid to remote islands and semi-mountainous areas through the usage of a drone and medical care robot, etc.

Utilization of AI speakers and butler robots

Work

Cultivating by automated tractors and drones, Automation of work such as planting, etc.

Monitoring of growing situations of crops and prediction of harvest

High accuracy in fish detection depending on the weather and the change in the temperature of sea water, etc.

24-hour reception/automatic response through the reception site on the Internet

- **The shortage and aging of human resources can be addressed through the automation and streamlining/sophistication of work in agriculture and fishing, etc.**

Living environment

Remove snow on sidewalks and private houses by snow-removing robots

Detect the failure of aged infrastructures, figure out the status and take the first aid at the time of a disaster by using robots such as drones

Utilize information such as the status of power use, judge if it's a vacant house, and automatically detect a suspicious person by installing a surveillance camera

- **Maintain or improve the living environment by utilizing robots, even if the budget and human resources are short.**

AI — What has already been put to practical use/ Things that are likely to be realized shortly (by around 2025)

AI — Medium term (up to around 2035)

(Note) Some examples of expected utilization are described. Examples are described with a view to the possibility of utilization without assuming the current system.

Healthcare

- From DNA information, health information, and daily conversations, it will be possible to offer suggestions for improving lifestyles, preventing diseases, and improving mental health, as well as being able to receive medical treatment remotely at home.

Advice for maintaining health based on the results of DNA analysis by AI.

Provision of content and proposals for actions for mental health understanding and improvements.

Recording daily physical conditions in apps and constantly monitoring implant terminals or sensors to provide information voluntarily when going to a live venue or a department store or make an AI analysis.

Housework

- In addition to automating almost all household chores, shopping can also be automated (automatic ordering by butler robots and automatic delivery to home by drone).

Automatic ordering and delivery depending on the stock status of ingredients and daily necessities using smart refrigerators.

Automation of recipe suggestions based on health status and DNA analysis results, depending on consumer preferences and internal sensors.

AI/Robot automation of all household chores.

Smart speakers and butler robots integrate and manage healthcare data and daily life data for use in various situations at home.

Suggestion of watching over the elderly and children, replacing furniture and introducing auxiliary equipment by utilizing living information, and supporting independence of the elderly.

Providing entertainment content according to each user's preference.

Automatically adjusts various environments in the room depending on the resident's age, physical condition, and mood (temperature, humidity, smell, lighting, BGM, the height of chairs and beds, changes in the interior by holograms, etc.).

Daily conversation with AI that can communicate at the same level as human beings and give the advice to enrich various lives through conversation.

AI proposes side jobs and volunteer activities suitable for individuals based on career, schedule, and lack of resources around (utilize free time by automating housework).

Proposal of marriage partner image and asset management proposal depending on personality

Safe and comfortable living environment

- In addition to being able to propose an environment in which elderly and children can spend safely, it will be possible to adjust the comfortable temperature, humidity, smell, lighting, etc. depending on the location and mood of each person.

Lifestyle

- AI capable of communicating at the same level as humans will enable to make optimum proposals in all aspects, such as daily life, turning points in life, and asset management.

AI: What has already been put to practical use/ Things that are likely to be realized shortly (by around 2025)

AI: Medium term (up to around 2035)

(Note) Some examples of expected utilization are described. Examples are described with a view to the possibility of utilization without assuming the current system.

Research

● **You can effectively reach optimum solutions due to materials informatics. In addition, further streamlining and new findings can be created when simple human work is replaced by robots.**

Automatically find scientific principles/solutions for certain problems

Material forming in a quick response to customers' requests

Predict composition of materials and optimum structure of elements (Materials informatics)

The number of times of experiments for simple work and cyclic operation will be done by robots or AI, and the number of times of experiments will increase.
(The total number of times of necessary experiments can be reduced by using AI.)

Development

● **AI can learn the latest fashion, technologies, and theory and device the concepts of products or food recipes that humans never think of.**

AI can learn successful cases in the past and social issues, etc. and devise popular products and the concepts of services.

Support planning of products and brainstorming at the time of development

AI that has adopted fashion and artisans can develop products

AI can propose the contents to pass screening and structure at the time of submitting theses and patent applications

The survey of patent information in Japan and overseas is implemented by AI and humans can focus on determination.

Various types of information for R&D and business strategy planning are effectively collected and analyzed by AI, so humans can choose the best one out of options.

High performance will be exhibited when tacit knowledge (knowledge of experts and excellent workers) becomes explicit and is analyzed.

Business entities to cooperate/ collaborate or specific ways of cooperation will be suggested from specific fields, resources, and knowledge databases.

日報

Contents of various activity records of employees (daily reports, e-mails, location information, voice, etc.) are analyzed and customer needs and market trends are grasped..

● **Researchers can focus on interpreting and conceiving when AI search load public information such as theses and patents, and support for making a choice.**

Common (streamlining)

● **R&D can be streamlined and sped up when knowledge remained in a company or outside the company (various fields) are combined.**

Common (Integration of knowledge)

AI What has already been put to practical use/ Things that are likely to be realized shortly (by around 2025)

AI Medium term (up to around 2035)

(Note) Some examples of expected utilization are described. Examples are described with a view to the possibility of utilization without assuming the current system.

Design

● **Consideration of product designs and facility layout, etc. can be streamlined and designs, etc. that humans didn't notice can be found.**

Profiling of target customers, proposal of some design plans based on the data used in similar products

Consider optimum facility layout, etc. based on the flow of people, consumption data, etc. in the area

Design products/facilities that meet safety standards by conducting a simulation based on various environmental conditions, etc.

Production Planning

● **They can make a production plan to maximize profits to streamline the work concerning production plans.**

Learn facilities, delivery dates, plans in the past, etc. and make optimum production plans, etc.

Adjust production volume and manufacturing costs based on supply-demand prediction.

Prepare building certification application, etc. automatically and apply automatically

Manufacturing

Analyze traffic lines at workshops as well as support work at factories/ construction sites, and give instruction to improve work efficiency

full automation of manufacturing lines/construction sites
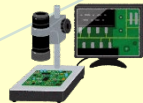
Automatically detect defective products by checking video images, etc. and remove them from the manufacturing line.

● **Solving the shortage of human resources, streamlining of tasks, and standardization of quality will be realized due to the work support or replacement by robots, etc. will be realized.**

Procurement

Search and recommend optimum parts, materials, construction materials, etc.

Automatically negotiate and adjust conditions such as prices with prospective customers for parts/materials, etc.

Order forms for many contractors and delivery information, etc. based on delivery control (request, etc.)

● **Searching ordering sites and tasks for delivery management will be streamlined. In addition, strategical work such as contract negotiation will be able to be sophisticated.**

(AI) What has already been put to practical use/ Things that are likely to be realized shortly (by around 2025)

(AI) Medium term (up to around 2035)

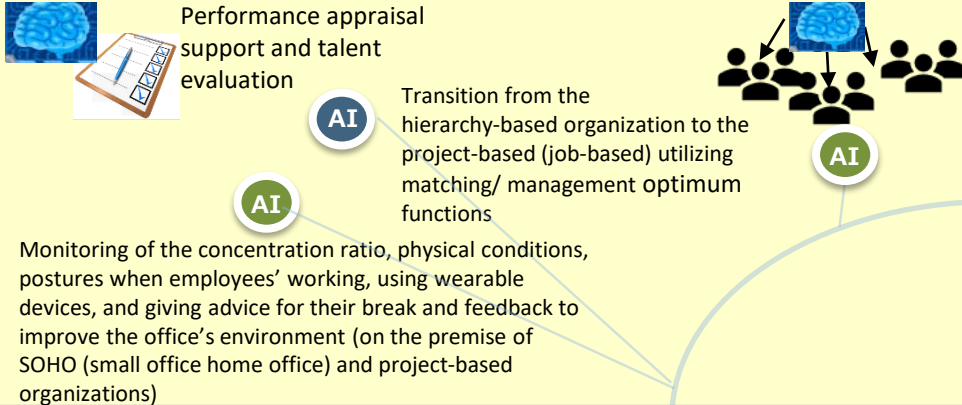(Note) Some examples of expected utilization are described. Examples are described with a view to the possibility of utilization without assuming the current system.

Logistics

- **By utilizing AI, unattended warehouses, and crewless transportation can be realized. AI will also be used for overall distribution management, which will enable delivery services that are difficult to perform manually.**

Unattended logistics operations in warehouses by utilizing AI-equipped robots and automated guided vehicles (AGVs).

Crewless transportation by realizing fully autonomous driving and delivery services that are not possible manually.
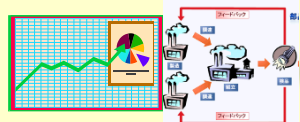
Management of entire distribution by AI (demand forecast, inventory adjustment, delivery route optimization, transportation resource arrangement, etc.).

Advertisement

- **By utilizing AI, it will be possible to make further improvements in the budget allocation and planning of advertisements, the customization of delivery contents to suit customers, and the measurement of advertising effectiveness**

AI's automatic generation of digital advertisements depending on each customer's hobbies/preferences. (Changing the content and the people who appear in the advertisements depending on the distribution destination.)

AI comprehensively measures the effect of advertisements based on the degree of SNS and blog coverages as well as the view rate and click rate.

AI budget allocation and plan decisions (how much money to spend on which media, at what time, etc.).

After-sales service

Feedback based on customers' voices to AI and people in each value chain

Personalized after-sales follow-up based on each customer's hobbies and preferences using AI (Apologies and sending of gifts, etc. depending on the generation).

AI answers to questions and complaints by email and through chats and supports inquirers at call centers.

- **AI will replace inquiries to call centers or by email and chats, and in the future, customer feedback will be automatically fed back to AI in each value chain.**

Sales
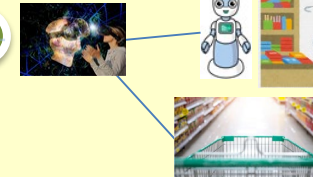
Shopping through remote control robots and shopping through virtual space experience.
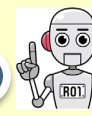
Shoplifting prevention and trouble detection using AI cameras.

A completely unattended store that utilizes AI, robots, RFID, etc. (stocking is also done automatically, and dynamic pricing with AI).

- **AI is used to automate simple tasks in sales operations and simple customer service/guidance, etc., and people will handle troubles and other tasks where advanced customer service is required.**

AI What has already been put to practical use/ Things that are likely to be realized shortly (by around 2025)

AI Medium term (up to around 2035)

(Note) Some examples of expected utilization are described. Examples are described with a view to the possibility of utilization without assuming the current system.
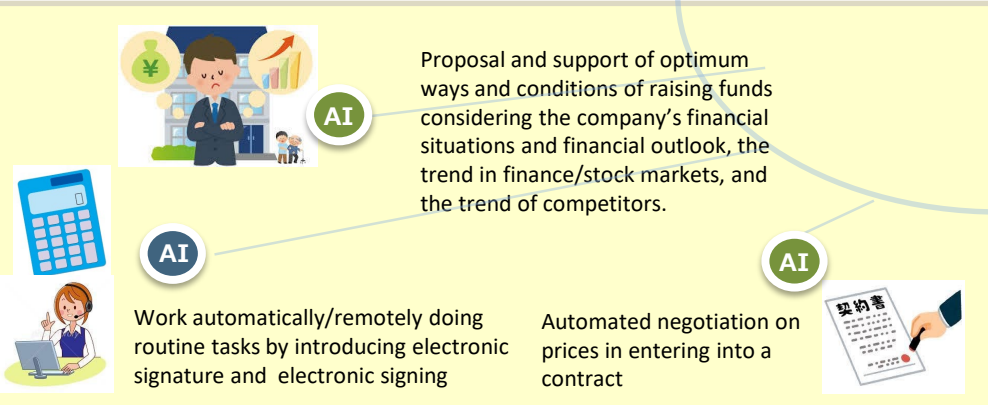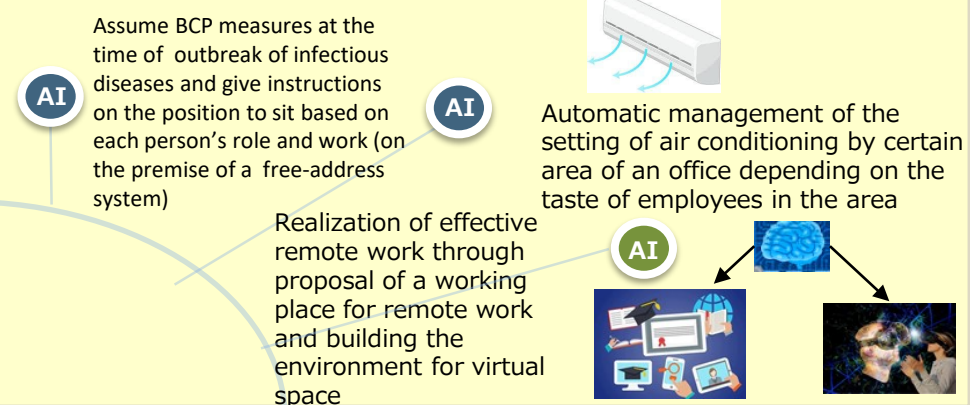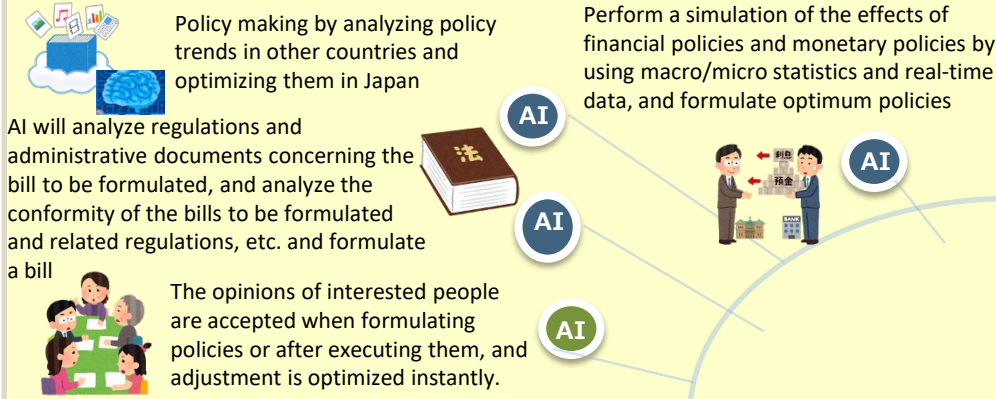
Humans

- **Human resources evaluation and human deployment using AI will be possible in a short-to-medium term. In a medium-to-long-term, AI will manage them based on project-based organizations and working at home.**

Performance appraisal support and talent evaluation

Transition from the hierarchy-based organization to the project-based (job-based) utilizing matching/ management optimum functions

Monitoring of the concentration ratio, physical conditions, postures when employees' working, using wearable devices, and giving advice for their break and feedback to improve the office's environment (on the premise of SOHO (small office home office) and project-based organizations)

Goods (Office Environment)

- **More efficient remote working will be possible by AI's proposal of the place of remote working and doing environmental support and building at virtual space.**

Assume BCP measures at the time of outbreak of infectious diseases and give instructions on the position to sit based on each person's role and work (on the premise of a free-address system)

Automatic management of the setting of air conditioning by certain area of an office depending on the taste of employees in the area

Realization of effective remote work through proposal of a working place for remote work and building the environment for virtual space

Money

Proposal and support of optimum ways and conditions of raising funds considering the company's financial situations and financial outlook, the trend in finance/stock markets, and the trend of competitors.

Work automatically/remotely doing routine tasks by introducing electronic signature and electronic signing

Automated negotiation on prices in entering into a contract

- **Electronic signature and electronic signing will be common, and the fully unmanned system of accounting/financial business using AI and the decision of price negotiation and ways or conditions of financing by AI will be possible.**

Information

Market forecast | Customer survey | Trends In competitors

Realization of effective detailed online general meetings of shareholders through effective Q and A and supplement of the contents of presentations, etc.

Support for business management based on prediction/analysis of various fields (proposal of the directivity of strategies, pointing out issues enterprises have and the points enterprises have overlooked, etc.)

Management Support

- **Visualization of information and multilateral analysis of various external information (market trends, the trends of competitors, etc.) will make the support for optimum management judgement.**

AI What has already been put to practical use/ Things that are likely to be realized shortly (by around 2025)

AI Medium term (up to around 2035)

(Note) Some examples of expected utilization are described. Examples are described with a view to the possibility of utilization without assuming the current system.

Policy making (national government)

- **By AI's analyzing various types of information and stakeholders' opinions and formulating policies, and streamlining and total optimization will be done, and agile-type administration will be realized**

Policy making by analyzing policy trends in other countries and optimizing them in Japan

Perform a simulation of the effects of financial policies and monetary policies by using macro/micro statistics and real-time data, and formulate optimum policies

AI will analyze regulations and administrative documents concerning the bill to be formulated, and analyze the conformity of the bills to be formulated and related regulations, etc. and formulate a bill

The opinions of interested people are accepted when formulating policies or after executing them, and adjustment is optimized instantly.

Administrative affairs / execution (national government)

- **Tasks will be streamlined by AI''s interpreting and authorizing, etc. , so quick response to enterprises, etc. will be realized.**

AI will analyze documents such as Diet's meeting minutes and trial cases at the request from business entities, etc. and interpretation of administrative laws will be clarified in annotations, etc

Support for determining conformity to regulations such as patent application and building certification application, etc.

Policy making (prefectures / basic municipality)

AI will analyze various types of data such as economy trends and the needs of citizens, and formulate administrative planning differentiated from other cities, satisfying the needs of residents. Tax rates for fixed property tax, resident tax will be determined.

AI will propose external resources concerning policy implementation, and streamline budget request related tasks by acquiring an estimate automatically.

Formulate behavior simulation and evacuation planning based on people flow data and population statistics obtained through sensing devices, etc. at the time of disasters

- **Tasks concerning policy making will be streamlined and policy making skills will be improved by AI's analyzing various big data**

Administrative affairs / execution (basic municipality)

Traffic volume of cars and pedestrians will be analyzed and predicted, so the fares of public transportation and general vehicle approach areas can be adjusted in real time.

AI speakers will be introduced to the households of isolated people, and needs and situations will be grasped in detail. Cooperation with local residents and organizations will be adjusted if needed, and sensitive services will be provided for citizens even in a situation of downsized civil services.

AI chat robot will respond to inquiries from citizens and streamline counter services

- **The satisfaction level of residents will be improved due to the streamlining of administrative affairs, promotion of cooperation, and real-time optimization of the ideal situation of towns, etc.**

AI What has already been put to practical use/ Things that are likely to be realized shortly (by around 2025)

AI Medium term (up to around 2035)

(Note) Some examples of expected utilization are described. Examples are described with a view to the possibility of utilization without assuming the current system.

Workstyle

- **The utilization of AI will bring about more free time because our work can be streamlined.**

◇Propose subdivided work (actions) just by setting goals
◇Support by a personalized secretary (no miscellaneous duties)
◇Streamlining simple work using AI or robots
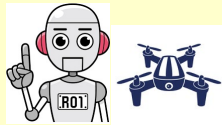
Leisure time

- **Disseminate remote work and realize workstyle beyond physical space**
- **Labor supply-and-demand matching beyond enterprises and national borders will be done.**

◇Dissemination of remote work (TV conferences/VR conferences)/establishment
◇Formulation of projects depending on individuals' capabilities, actual results, free time /job matching
◇Participation in global projects by utilizing multilanguage translation via AI
◇Work/experiences beyond space using Telexistence

Capabilities/ Actual results

- **Human capabilities can be expanded due to the utilization of AI/robots, etc., and you can participate in society, provide values and have experiences that had not been done due to the restriction of time/space/regions/physical abilities.**

◇Adding value work beyond human capabilities by expanding capabilities
◇Participate in society by expanding abilities regardless of physical abilities

◇ Volunteer activities (pro bono activities, etc.) by Telexistence robots, etc. in developing countries

How to spend leisure time

- **How to spend increased leisure time will be fulfilled**

◇Propose how to spend leisure time by setting goals
◇Propose new hobbies and experiences depending on personal experiences or emotions
◇AI speakers will recommend topics based on the family's interests.

- **Opportunities to relearn utilizing increased leisure time will be provided.**

◇Relearn using learning contents provided depending on individuals' hobbies/interests
◇Vocational training and relearn for career enhancement that matches work experience and employment placement
◇Vocational training for career enhancement

◇Travel experiences using VR and Telexistence robots
◇Extended healthy life expectancy by expanding physical abilities

(Note) Some examples of expected utilization are described. Examples are described with a view to the possibility of utilization without assuming the current system.

Workstyle

- Everyone can make a transition to creative work, and individuals' capability and income will be more linked.
- The "trust" and "actual results" of individuals will determine their income. In addition, the trustworthiness and actual results will be quantified, and they will create value like the currency.
- People's workstyles will make a transition to project-based workstyles beyond boundaries of enterprises, and freelance work and sideline business will increase. (The premises for employment structures and formulation of projects will change)
- Regardless of their background (the company they belong to, residential area, age/gender, disabled or not), they will be able to freely participate in society, using their capability and hours (ageless/genderless, etc.)

Trust/ Actual results
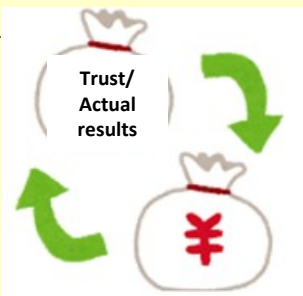
How to spend leisure time

- They can decide where to live and how to use based on private life without the restriction of their job.
- They can keep learning something new without having the restriction of time and places.
- The free time will definitely increase, and people will think what is really important for humans.
- The costs necessary for living will decrease, and the consumption where they can feel value will increase. (Pursue of their own way and new experiences)

- "Work for living" will be minimized, and people will be involved in labor and social activities in the scope of mission and hobbies.
- Everyone can lead a fulfilling life, expanding their capability by utilizing AI and requesting others for cooperation and adjusting their opinions by utilizing AI, and the degree of freedom of participating in society will expand by utilizing AI.
- They will live in a place where income and living costs are well-balanced, and adjust the living environment they put priority on, then think about "what is really necessary for humans (themselves)" and invest their time and costs on them.
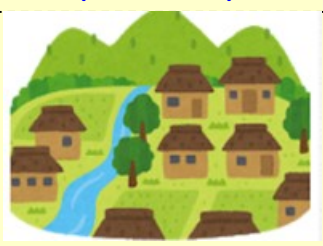
②Case Studies on the Implementation of AI in society

- ○ Transfer (Fully autonomous driving)
- ○ Health (medical care/nursing)
- ○ Finance
- ○ Crisis management (crime prevention, public infrastructure, and disaster prevention)
- ○ Manufacturing
- ○ Residential
- ○ Energy

Expected benefits (example)

- Humans will not need to drive, and travel time can be effectively utilized when traveling by car.

- Older people and people with disabilities will be provided with a convenient means of transportation, which will allow them to go to the hospital or go shopping smoothly.

- People will not need to drive long-distance trucks or long-distance buses at midnight or early morning, and they will be able to review their workstyle and work-life balance.

- In particular, problems such as a shortage of drivers for route buses in rural areas can be improved, and the abolition and reduction of routes can be avoided.

Expected issues (example)

	Before realization	After realization
Society	• It is unclear whether autonomous driving is technically secure or who is responsible for accidents if any. Therefore, there is a possibility that the service will not be accepted due to people's feelings of resistance to autonomous driving.	• The flow of using the time devoted to commuting and attending school for other purposes will be created. As a result, there is a possibility that the places and lifestyles of individuals will change significantly.
Economy	• In the case of infrastructure-coordinated autonomous driving, infrastructure may not be developed in local governments due to tight budgets, and there may be regional disparities in the spread of autonomous driving. • Employees related to delivery and transportation services may be reduced, making it difficult for them to find other jobs. Implementation of AI cannot be accepted socio-economic as a whole.	• Automakers, which are becoming increasingly popular, can secure a lot of post-sales learning data, which may hinder the entry of newer automakers. • The lack of driving by humans could significantly reduce the accidents that have previously occurred as a result of human error and would require a significant change in automobile pricing for insurance.
Technology	• AI may behave unpredictably with respect to data not belong to the training data. In addition, even with using accurately trained AI (model), we may not avoid erroneous recognition and derecognition.	• AI may not be able to respond to changes in the world after their deployment. • There is a possibility that proper operation cannot be performed because negotiations and adjustments cannot be made between cars. • If the AI system is hacked, not only will the autonomous vehicle not function properly, but it may also affect other autonomous vehicles via the network one after another, resulting in accidents and traffic disruptions.
Law	• The black-boxing of AI may make it difficult to establish the legal responsibility for autonomous driving, which may make it difficult to form a consensus with automobile manufacturers and users	• In addition to domestic legislation, coordination with other countries will be necessary, and it will not be possible to deal with the current legal system alone. Each automobile manufacturer may be forced to take new measures.

(Note) Some examples of expected benefits and issues are listed.

Expected benefits (example)

- By making a DNA and lifelog analysis with AI, it will be possible to give detailed advice for improving the health depending on the individual's health condition.

- An AI chip embedded in the body collects information on the body and analyzes it, enabling early detection of abnormalities and diseases.

- Image analysis using AI will lead to the early detection of illness and improvements in the prevention of oversight. It will also contribute to reducing the burden on doctors and solving problems, such as doctor shortage and uneven distribution.

- By expanding the physical capabilities of wearable robots (wearable robots and robot suits), older people with physical disabilities and care recipients can live independently.

Expected issues (example)

	Before realization	After realization
Society	• Considering the accuracy of AI diagnosis and people's trust in AI, if the diagnosis is left only to AI judgment, it may not be possible to obtain the patient's understanding.	• Older people, their families, care workers, etc. may not be able to understand the proper usage of wearable robots fully.
Economy	• In the medical field, a high degree of medical knowledge is required to create training data, which may impose an excessive burden on doctors.	• With the spread of wearable robots and AI chips embedded in the body, more learning data will be collected, which may create an oligopoly market.
Technology	• If the standardization of medical information/healthcare information system/data format does not make progress, the distribution of data, such as medical information, may be hindered, and AI training based on large-scale data may not progress.	• There is a possibility that the AI system will become a black box, and medical doctors will not recognize or understand the risks of medical treatment using the AI system. Then no appropriate and sufficient informed consent will be provided to patients and families.
Law	• When handling personal information at prefecture/municipal hospitals, the Personal Information Protection Ordinance will be applied instead of the Personal Information Protection Act, which applies to the private sector. In the Ordinance, there are cases where there is a provision that prohibits information linking with external systems as a rule (prohibition of online linking), and there is a possibility that the cooperation and learning of data via the system will not proceed.	• Regarding services that utilize information, such as life logs, there are cases where different individuals re-learn the information based on information input by smartphone. In that case, there may be an error in some personal data input, and a trained model that gives incorrect advice may be constructed. At that time, the legal demarcation point/responsibility ratio may be unclear between individuals and service providers.

(Note) Some examples of expected benefits and issues are listed.

Expected benefits (example)

- It will be possible to provide insurance products (life insurances, automobile insurances) with different insurance premium rates depending on the health status or car driving skills.

- Insurance products (life insurances) customized to each person depending on the genome information, etc. will be provided.

- If a traffic accident occurs, the insurance amount will be instantly calculated from the photo/picture of the site, and the period before the insurance amount is paid will be shortened.

- AI will comprehensively analyze the family structure, salary income, drop-at-expiration information such as investment trust, financial assets, latent losses, and property status of borrowing, etc., and designing the optimum asset formation plan including the first and second generations will be automatically possible in the future.

Expected issues (example)

	Before realization	After realization
Society	• People might refuse to provide data for insurance/financial institutions or feel resistance in utilizing AI, fearing the impact on the invasion of privacy, finding employment or marriage, etc.	• The data on people's health or driving, and genome information might be taken behind their back and be profiled, then they might be discriminated in marriage. • If the data common in the financial field are integrated on the credit approval AI platform, and the assessment of a person on the platform is lowered, he/she might be put at a disadvantage in various fields (loan examination, application for insurance, etc.)
Economy	• Heavy investment might be needed to introduce highly advanced AI, and the introduction might not be proceeded.	• It would be highly possible that the introduction of highly advanced AI will require much investment, so the introduction of AI into local banks, Shinkin banks, and small-sized insurance companies will be sluggish, and the disparity between small-sized companies and large ones will be large. • If most people utilize AI for their asset formation, the utilization of AI will be concentrated on the AI with good performance, so the balance of the financial market might be lost.
Technology	• Insurance products that fully adopted highly advanced AI might not ensure transparency • Companies might be reluctant to utilize AI in the field, fearing the difficulty in securing the quality or high risk of getting wrong results.	• If on what kind of basis AI calculated the insurance amount for the products depending on the health status or skills of driving cannot be explained, the appropriateness of the amount of insurance might not be judged. • There is a possibility that insurance amount might not be calculated or assessed appropriately, if appropriate data are not used or the amount of data for learning is not enough and the accuracy of image recognition or character recognition is low.
Law	• Insurance products might not be approved because the conditions of conformity to insurance products established by Financial Services Agency cannot be judged.	• The data or genome information on people's health or driving might be obtained and utilized for unapproved purpose behind their back, so their privacy might be invaded or they might be put under a disadvantageous situation in finding a job.

(Note) Some examples of expected benefits and issues are listed.

Expected benefits (example)

○ Utilizing a surveillance camera will enable us to prevent or detect crimes, and rush to a crime scene quickly.

○ Repair robots will be able to automatically repair depending on fault prediction or abnormality detection at infrastructure such as roads or bridges, so we will be able to use them safely and securely, and those robots can safely do repairs at a place where it's hard for humans to do work.

○ In disaster response, we will be able to do disaster prediction (including secondary disasters), and support for the minimization of disasters and swift restoration such as proposing recovery plans depending on the damage situation and regional factors, as well as send alerting information.

Expected issues (example)

	Before realization	After realization
Society	• There is a possibility that the introduction of AI might be sluggish because it's hard to gain people's trust for AI regarding disaster prediction and planning for recovery plans.	• If false alert is issued regarding disaster prediction, the trust for AI from residents will be lowered and AI might not be used continuously.
Economy	• In installing a sensing device, the approval from the installation site will be required, but if a number of sensing devices are needed to be installed, the sites may have different administrators such as the nation, prefecture, city or municipality or private individuals, it might take time and labor for coordination.	• In case of fault/abnormality detection systems that are installed in the ground where people can't enter easily, there is a possibility that a monopolistic market might be formed by enterprises that got approval from administrators, outwitting competitors and secured learning data.
Technology	• If the accuracy of disaster prediction is not enough partly because the AI has not learned from appropriate data, sending alerting information might not be done or be late, so the introduction of AI might be wavered.	• If the AI working on detecting criminal acts is hacked, the AI's program might be tampered in a way it doesn't detect criminal acts, and the AI might overlook crimes.
Law	• Regarding personal information that can be obtained from sensing devices, the administrators of devices are different, the regulations applied to the devices might be also different, so there is a possibility that they should be dealt with pursuant to applied regulations, and the introduction of AI might be sluggish.	• If a crime such as a shoplifting at a store, etc. is misdetected, and a private security firm and the police come to the site, the misdetected person voluntarily goes to the police, responding to the request, and a person who was in a store posts he was a criminal through SNS, the person's social reputation might be hurt.

(Note) Some examples of expected benefits and issues are listed.

Expected benefits (example)

○ Based on external input (actual sales results, results of demand forecast, sales of competitors, etc.), AI will be able to handle optimum production planning and material procurement procedures, etc. based on production planning.

○ Thanks to robots controlled by AI, the full automation of manufacturing lines and inspection, etc. will be realized.

○ Factories will be fully controlled by AI, and full automation will enable the limited production of a wide variety of products, so the optimization of the utilization of resources concerning the production in multiple factories will be possible.

○ Detection of abnormalities, alarm transmission, and fault prediction will be done based on the information obtained from the installed sensor of the post-sales products.

Expected issues (example)

	Before realization	After realization
Society	• After realization of full automation, implementation of a large-scale downsizing is expected, so the psychological resistance at sites is extraordinary, and the investment might be sluggish.	• At the time of realization of full automated factories, reeducation/ reutilization of human resources might not be done at the enterprises, and the unemployment rate might increase significantly when massive restructuring is implemented.
Economy	• Medium and small-sized enterprises might be reluctant to release their production capacity and operational status, so the introduction of IoT platform/AI and the transaction of AI with business contacts might become sluggish.	• The gap between large enterprises that can introduce full automation facilities and medium and small-sized enterprises that can't do so might be further widened. • If AI is hacked or misjudge, it may cause heavy damage to the company or business contacts, or leakage of information on production technology, and the competitiveness of the company and nation might decline.
Technology	• If API and data format, etc. are different, effective automation might not be done or developed even with the introduction of AI.	• If industrial robots and production plan formulation/factory control AI are hacked or they have not learned from appropriate data, or the learning data are not enough, they might misjudge. • In case some troubles occur, the cause may not be identified, and the time required for restoration will be more than the time when the manual/ ordinary system was used.
Law	• The provided data's copyright of learning data providers (major manufactures) and AI development vendors and profit distribution are not legally organized, data might not be collected. • Under Japan's current system, it's hard to promote restructuring. As a result, the investment on full automation might not be proceeded.	• If the responsibility division between the provider of learning data, labeling practitioners, and AI developers and liability for compensation are not legally organized, there is a possibility that enough compensation or support might not be provided in case of troubles, etc.

(Note) Some examples of expected benefits and issues are listed.

Expected benefits (example)

○ They can predict what time their family members will come home from his/her GPS information and behavior history, and they can automatically optimize the indoor temperature and adjust their housework such as cleaning and cooking depending on the time when their family members will return home.

○ They can figure out the taste of their family members, judging from the health status, behavior history, and meal history of their family members, and determine the menu. They can order food ingredients, depending on the stock status of food in a fridge, etc., and cooking robots will cook the food ingredients.

○ They can take care of children and seniors utilizing pet robots when their parents are away from home.

○ AI speakers can provide various contents (TV programs, video, recommended news articles, comic books, books, music, etc.), depending on a person's taste, the status of the family, and the contents of conversation.

Expected issues (example)

	Before realization	After realization
Society	• There is a possibility that people might become negative about the introduction of AI home appliances and AI speakers because they feel excessively uneasy about giving the information of family matters or situation to AI.	• People's privacy might be invaded or their information is used for a wrong purpose when their health, hobbies and tastes, information of being at home/away from home, dietary life, etc. are utilized behind their back for the disagreed purpose.
Economy	• If households in Japan are not financially comfortable enough, AI or AI home appliances that control the entire house might not be spread. (There is a possibility that only affluent homes might use AI or AI home appliances in terms of the replacement of people and improvement of comfortability).	• If AI for the residential is provided by several platformers, and most parts of the consumption of households are automatically are done by AI, there is a possibility that the power of platformers will be too powerful and have bad influence on economy.
Technology	• API and communication formats, etc. need to be standardized so that AI home appliances of different manufactures can cooperate with each other.	• There is a possibility that accidents and troubles might occur at many homes and tremendous impacts like major power outage might be put on economic activities and city functions if the AI for the residential of a major enterprise is hacked.
Law	• If AI home appliances of different manufactures don't cooperate with each other to legally clarify the compensation or where the responsibility lies for an accident or fire when housework is done fully automatically, the cooperation between different manufacturers might not proceed and only partial automation might be realized.	• If households rely on AI in various aspects, there is a possibility that serious damage such as ransomware attack (a malware in which the AI is taken as a hostage and ransom is demanded by a hacker) might occur frequently. As the attack/damage is unprecedented, there is a possibility that existing legal system may not be able to cope with it.

(Note) Some examples of expected benefits and issues are listed.

Expected benefits (example)

○ The electricity usage will be adjusted at home, offices, factories, etc. by AI to limit on maximum power consumption.

○ The AI will adjust storage, usage and selling of the electricity generated by solar power, etc. at home at the best timing.

○ The AI of undertakers by power industry will automatically and in real-time handle output power control by connecting the power source of renewable energy.

Expected issues (example)

	Before realization	After realization
Society	• There is a possibility that companies or homes that generate and sell electricity might not understand AI's output control of renewable energy for systems.	• If the reason for AI's conducting output control isn't clear enough, the companies that sell electricity of renewable energy might criticize electric power utilities for conducting output control.
Economy	• There is a possibility that homes might not understand the AI that adjusts electricity usage and the introduction of AI might not proceed.	• There is a possibility that if AI conducts output control for renewable energy for systems, there might be appropriate limit on the frequency of control, and opportunity loss due to output control in home or companies that generate/sell renewable energy can't be predicted when it's not open to the public.
Technology	• In the field of electricity that is expected to supply electricity as lifeline, if the AI's capability to conduct appropriate control isn't verified, the introduction of AI might not proceed.	• In case unexpected events such as disasters, etc. occur, there might not be appropriate adjustment of electric power consumption or stable supply of electricity because electricity power consumption, etc. in case of unexpected events isn't understood enough. • As for output control and electricity supply, there is a possibility that AI might be unjustly discriminated.
Law	• In case the homes where several households live together introduce the service where AI adjusts electric power consumption, there is a possibility that the service might not be spread because of the invasion of privacy if the housemates except for the contractors don't agree with handling of the data.	• If AI is introduced in output control and demand response and supply of electricity is canceled, a cause-and-effect relationship might be unclear, and it might be difficult to clarify where the responsibility lies.

(Note) Some examples of expected benefits and issues are listed.