Impacts and Risks Caused by AI Networking, and Future Challenges

(From Studies on AI Networking in Japan)

November 17, 2016

Tatsuya KUROSAKA
Project Assistant Professor at Keio University
Graduate School of Media and Governance

Evaluation of Social and Economic Impacts Caused by AI Networking

"Conference on the Networking among AIs" evaluated social and economic impacts caused by AI networking in the time series from 2020s to 2040s in each field of public, life, and industrial areas.

[Public area]	Public infrastructure, disaster prevention, smart cities, public administration.
[Life area]	Life support (personal assistance), creation of richness.
[Industrial area]	Common matters (corporate business, etc.), agriculture, forestry and fisheries, manufacturing, transportation and logistics, wholesale and retail, finance and insurance, medical and nursing care, education and research, service industry, construction.

[Sample 1] Manufacturing

It is expected that smart manufacturing processes and supply chains will emerge around 2020, and production optimization and advanced multi-product variable production (customization) will be realized in response to the dynamic balance of demand and supply.
In addition, digital marketing, high value-added after-sales service, and maintenance services based on the analysis of operational data on users will be realized.
Furthermore, the automation of production beginning with the design phase of products is expected in the second half of the 2020s, and efficiency and speed improvements in development work will be realized.

2020 — 2030 — 2040

- ▲Widespread use of cooperative robots that can work with people [MRI]
- ▲Realization of unmanned maintenance*2 (2020) [Future]
- ▲Improvements in product demand prediction and the efficiency of supply chains based on real-time data [I4.0]
- ▲Lead-time reduction through the use of demand data [I4.0]
- ▲Realization of smart industrial robots and machine tools for advanced multi-product variable production (mass customization)*1 (2020) [Future]
- ▲Realization of a significant reduction in construction time by on-demand manufacturing at mobile factories (2020) [Future]
- ▲Realization of high value-added after-sales service and maintenance service based on the analysis of operational data on users using the products. (2020) [Future]
- ▲AI robots will learn skilled workers' intuition and knack [MRI]
- ▲Introduction of AI in the designing, prototyping, and testing of products for improvements in product development efficiency and speed [MRI]
- ▲Improvements in product cost performance [MRI]
- ▲Emergence of autonomous robots that can respond to complex environmental changes, such as production stage changes (2029) [White Paper]
- ▲Realization of zero design lead time and zero inventory" (2030) [Competition]
- ▲Transition from standard products to tailor-made products (2030) [Competition]
- ▲Standardization of large companies' unmanned plants [MRI]
- ▲Semi-automation and full automation of product designing [MRI]

*1. AI will predict the future demand for products from consumers' purchasing behavior.
*2. Free of manual maintenance.

[Sample 2] Medical and nursing care

The disease prediction of patients based on their vital data and the health management of people based on their gene information will be realized, thus resulting in an extension of healthy life expectancy.
It is expected that the automatic analysis of research papers will be realized in the 2030s, and medical research and new drug development will be accelerated.

2020 — 2030 — 2040

- ▲Use of AI diagnosis support to improve diagnosis accuracy and reduce misdiagnosis [MRI]
- ▲Practical application of guidance robots for the visual impaired (2016) [White Paper]
- ▲Marketing of pushcart-type walking aids equipped with sensors [White Paper]
- ▲Practical application of technologies to detect abnormalities in motor functions that are not detected by body sensors, etc. (2017) [White Paper]
- ▲Dissemination of second opinion services using AI [MRI]
- ▲Dissemination of services to predict disease onset based on vital data [MRI]
- ▲Practical achievement of diagnostic imaging and automatic detection of lung cancer, etc. [MRI]
- ▲Practical achievement of health management using genetic information (2020) [Future]
- ▲Automatic pharmaceutical preparation [MRI]
- ▲Health management through ubiquitous biological information monitoring (2023) [White Paper]
- ▲Improvement of senior citizen QOL through the use of actuator technologies that can assist motor functions (2023) [White Paper]
- ▲Expansion of second careers and the senior economy through extension of healthy life [MRI]
- ▲Practical application of assistance network robots that help senior citizens get out of the house (2028) [White Paper]
- ▲Use of sensors and actuators to support medicine, healthcare, health maintenance, and activities of people with disabilities* (2030) [Hirai, Member]
- ▲Dissemination of functions to improve dementia and strengthen cognitive ability [MRI]
- ▲Dissemination of new drug development by pharmaceutical companies using AI [MRI]
- ▲Reduction of medical costs through extension of healthy life [MRI]

* Specific examples: Support for operations through monitoring of accident status, etc., social welfare and infrastructure construction to monitor abnormal behavior and provide healthcare and independent living assistance, etc., and two-way remote medicine, etc.

1

Examples of Social and Economic Impacts (1/3)

Fields	Examples of Impacts
Public area (community)	
Public infrastructure	- The real-time collection and analysis of data on the supply and demand of public infrastructure will enable an immediate response to sudden environmental changes. - The automation of maintenance will achieve efficiency.
Disaster prevention	- The real-time prediction of the influence of disasters will increase in sophistication, and evacuation guidance linking with the prediction will lessen the damage.
Smart cities	- The utilization of street cameras and the realization of energy management will realize comfortable, safe, and efficient cities.
Public administration	- The utilization of the AI analysis result of open data on relevant policies and institutions will benefit to level improvements in public administration. - With the realization of forecasting utilizing information transmitted from each individual and enterprise, the planning of policies that are more precise will be possible.
Life area (people)	
Life support (personal assistance)	- By utilizing body and indoor sensors and robots, housework and chore support will decrease the load of human. - AI capable of exchanging a natural conversation with humans will appear around 2030.
Creation of richness	- Personal fabrications will become widespread and product and service users' own customization will occur as common matters. - Encounter support and experience sharing will be sophisticated as a result of the development of sensors and media, and a possibility of qualitative changes people's connections will be expected.

2

Examples of Social and Economic Impacts (2/3)

Fields	Examples of Impacts
Industrial area (work)	
Common matters (corporate business, etc.)	- The automation of simple tasks, such as back-office operations, customized for each individual (e.g., personal secretarial services) will achieve work efficiency.
Agriculture, forestry, and fisheries	- Automatic cultivation, agricultural drones, intelligent farming, and other innovations will improve production efficiency and a yield expansion.
Manufacturing	- Smart manufacturing processes and supply chains will realize production optimization and advanced multi-product variable production (mass customization), in response to the dynamic balance of demand and supply. - Based on the analysis of operational data on users, digital marketing, high value-added after-sales service and maintenance service will be realized. - The automation of production beginning with the design phase of products is expected in the second half of the 2020s, and efficiency and speed improvements in development work will be realized.
Transportation and logistics	- The reduction of accidents, elimination of traffic congestion, the reduction of environmental impacts, and resolution of regional "traffic refugees," including elderly people, will be achieved as a result of level improvements in autonomous driving.
Wholesale and retail	- The utilization of the analysis results of data on customers of intelligent commerce, purchase recommendations, etc., will stimulate customers' consumption.
Finance and insurance	- The sophistication and divergence of products and services will be expected as a result of the refinement of risk assessment. - The automation of trading, loan screening, and credit management will become widespread around 2030.

3

Examples of Social and Economic Impacts (3/3)

Fields	Examples of Impacts
Medical and nursing care	- The disease prediction of patients based on their vital data and the health management of people based on their gene information will be realized, thus resulting in an extension of healthy life expectancy. - Medical research and new drug development will be accelerated by the automatic analysis of research papers.
Education and research	- Detailed education, ranging from the learning of subjects to career development, according to each individual will make progress. - The tacit knowledge of excellent performers, skilled technicians, and creators will be formalized and archived, which will improve education efficiency.
Service industry	- The automation of comparatively simple jobs in security service, backyard work, and response services at call centers will make progress. - The automatic evaluation of the reasonable prices of real estate will facilitate real estate transaction.
Construction	- The introduction of robot technology to dangerous work and painful work will make it easier to work on construction site for women and elderly people. - Sensors that will detect the deterioration of structures and new functional materials as a result of advanced data analysis will be developed, which will further enhance the safety of buildings.

4

Risks Caused by AI Networking (1/2)

The conference classified social, economic, ethical, and legal risks caused by AI networking as follows*.

1. Risks Associated with Functions: Functions that are expected in the AI network system do NOT work appropriately.
2. Risks related to Legal System, Rights, or Interests: AI network system infringes rights or interests.

** Some risks have both sides. (example: Risk of accident)*

For studying the ideal state of evaluation and management of risks, examination of scenarios that imagine an actual applications of AI network system will be needed. (*I.e.*, Risk scenario analysis)

Type of Risks	Examples
Risks Associated with Functions	
Security-related risks	- Hacking and cyber attack on AI network system. - Surreptitious attack on AI network systems without attracting anyone's attention.
Risks related to information and communications network systems.	- Occurrence of unintended situation caused by intermingled with various AI in information communication network. - Occurrence of unintended situation caused by irregular work of AI when information communication network has some trouble. - Data leak and data loss from clouds, and system failure.
Opacification risks	- As AI algorithm becomes opacified, appropriate control of AI network system becomes difficult for human.
Risks of control loss	- As AI network system runaways, control by human becomes difficult or impossible.

5

Risks Caused by AI Networking (2/2)

Type of Risks	Examples
Risks related to Legal Sys, Rights, or Interests	
Risks of accidents	- Accident by the action of an autonomous vehicle or robot on an autonomous decision basis.
Risks of crimes	- Crime by malware abusing AI network system. - Terrorism or crime by autonomous weapon system.
Risks related to the rights and interests of consumers, etc.	- Inappropriate application of AI network system infringes rights and interests of consumers and young people, etc.
Risks related to the infringement of privacy and personal information	- As collection and application of personal information by AI network system becomes opacified, control of personal information becomes difficult. - AI network systems infringe privacy by surmising people's intentions, health, or future actions, etc.
Risks related to human dignity and the autonomy of each individual	- AI network systems infringe individual autonomy by invisible manipulation of human's decision making processes. - Collapse of the value system of the human-central principles by the technological singularity.
Risks related to democracy and governance mechanisms	- AI network system's bad influence on voting and people's behavior. - As AI network system is applied to the governance of the nation, decision making processes become opacified and the location of responsibility turns ambiguous.

6

Future Challenges

1. Formulation of Basic Principles for Research and Development "AI R&D Guidelines"
2. Facilitation of Cooperation toward the Development of AI Networking
3. Securing of Competitive Ecosystem
4. Challenges for Promotion of Economic Development and Innovation
5. Setting Evaluation Indices on Impact of Development of AI Networking and Richness- and Happiness-related Indices
6. Protection of Users
7. Ensuring Security for the AI Networking
8. Institutional Issues relating to Privacy and Personal Data
9. Institutional Issues relating to Content
10. Study of Basic Rules of Society
11. Creating and Sharing Risk Scenarios
12. Accelerated Advancement of Information and Communications Infrastructure
13. Prevention of the Formation of AI Network Divides
14. Issues related to Ideal State of Human Existence
15. Fostering of AI Network System Literacy
16. Personnel Training for the AI Networking
17. Improvements in Working Environments in Response to AI Networking
18. Establishment of a Safety Net
19. Contribution to Human Happiness through the Resolution of Global Issues
20. Approach to Governance of the AI Network Systems

7

Relationship between Future Challenges and four types Issues

	Institutional issues	Economic issues	Social and ethical issues	Technical issues
1. Formulation of Basic Principles for Research and Development "AI R&D Guidelines"	◎	○	◎	◎
2. Facilitation of Cooperation toward the Development of AI Networking	○	◎	○	◎
3. Securing of Competitive Ecosystem	◎	◎	△	○
4. Challenges for Promotion of Economic Development and Innovation	○	◎	△	○
5. Setting Evaluation Indices on Impact of Development of AI Networking and Richness- and Happiness-related Indices	○	◎	◎	○
6. Protection of Users	◎	◎	◎	○
7. Ensuring Security for the AI Networking	○	○	△	◎
8. Institutional Issues relating to Privacy and Personal Data	◎	○	○	○
9. Institutional Issues relating to Content	◎	◎	○	○
10. Study of Basic Rules of Society	◎	○	○	○
11. Creating and Sharing Risk Scenarios	◎	△	○	◎
12. Accelerated Advancement of Information and Communications Infrastructure	○	○	△	◎
13. Prevention of the Formation of AI Network Divides	○	◎	○	○
14. Issues related to Ideal State of Human Existence	○	○	◎	○
15. Fostering of AI Network System Literacy	△	△	◎	◎
16. Personnel Training for the AI Networking	○	◎	○	◎
17. Improvements in Working Environments in Response to AI Networking	◎	◎	○	△
18. Establishment of a Safety Net	○	◎	○	△
19. Contribution to Human Happiness through the Resolution of Global Issues	◎	◎	◎	○
20. Approach to Governance of the AI Network Systems	◎	○	◎	○

* A strong relationship, moderate relationship, and weak relationship between each issue and region are shown by ◎, ○, and △, respectively. 8

Detail of Future Challenges (Extract)

11. Creating and Sharing Risk Scenarios

- **<u>Creating scenarios of various risks</u>** assuming the scenes of the utilization and application of AI network systems.
- **<u>Promotion of countermeasures</u>** based on scenarios against risks.
  - ➢ Risk assessment (Time of occurrence, occurrence probability, scale of damage etc.)
  - ➢ Risk management (risk prevention, operation stoppages and disconnection from networks in response to incidents, implementation of improvements, etc.)
  - ➢ Risk communication (e.g., scenarios shared by each stakeholder in society).
- **<u>Ongoing reviews of scenarios</u>** in accordance with the development of AI networking.
- Study on the ideal state of the **<u>government's initiatives</u>** with consideration of scenario.

9

Detail of Future Challenges (Extract)

20. Approach to Governance of the AI Network System

- Study on the **role sharing of hard laws** (e.g., administrative regulations and criminal regulations) **and soft laws** (e.g., agreements between stakeholders and forum standards) for the governance of AI network systems.
- Study on the ideal state of **consensus building among stakeholders** on AI network systems.
  - Study on the ideal state of the **process design of consensus building** among stakeholders.
  - Study on the ideal state of **communication between experts and non-experts**.
- Study on the ideal state of **opportunities to participate in the process of international rulemaking** on AI network systems and **maintenance of the transparency** of the process.
- **Formation of opportunities for international discussions** about issues concerning the governance of the AI network systems such as formulation of "AI R&D Guidelines".
  - Formation of **opportunities for domestic discussions** in preparation for international discussions.
  - **Promotion of research and study** on the ideal state of the governance of AI network systems.

10

My opinion

- Remember the history of the internet
  - We can learn the deployment of new technology to our society.
    e.g. Connectivity -> Web -> Broadband -> Mobile -> IoT
  - As a result, we concern today on information security and privacy.
- Understand the difference
  - Is AI a next step from latest migration like IoT?
  - AI will become the networked system to collaborate each other.
  - "Unpredictable technology" is a key to find the difference.
- Find the reasonable transparency
  - Who can care about transparency?
  - Reasonable transparency should be a movement and/or framework that Users and Experts work together to clarify the ordinary and extra-ordinary condition.

11

Conclusion

- First of all, “AI Network System for Humankind”
  - AI Network System must be ruled by humankind as user themselves.
  - “User” includes not only “individual” but “company” and/or “community.”
  - Users expect the availability of valid, affordable, controllable, safe and secured AI Network System.
- Never stop innovation to “AI Network System”
  - AI Network System can help us to create the “user-centric” society (if we want it.)
  - Japan prospects the potential of AI Network System due to facing the social problems.
- Think about ecosystem
  - What kind of ecosystem? Who takes the top?
  - The ecosystem should be developed with responsibility to “user.”

12

Japan would like to talk on “AI Network System” with you!

Thank you for your attention.