Study Group 'AI governance and its Evaluation'
Report on the Session #5(Phase Ⅱ)

1. Introduction

The Japan Deep Learning Association establishes study groups as a forum for deepening knowledge and discussing domestic and international policy trends related to artificial intelligence (hereafter AI) and Deep Learning (hereafter DL). This study group, 'AI Governance and its Evaluation,' defines 'governance' as a system of management and evaluation by various actors and launched a study group in July 2020 to investigate what forms of governance are possible to help build trustworthy AI systems, and the phaseⅡ began in September 2021.

In the fifth meeting (December 10, 2021), Prof. Michiko Watanabe of the Faculty of Data Science, Rissho University spoke in the first half on "Data Science Education in the Age of AI." In the latter half, Mr. Makoto Koizumi from Digital Literacy Council spoke about, "The Future Social Implementation, DX in Organizations and Human Resource Development."   This report is a reconstruction of these topics and a record of the discussion.

2. Data science education in the age of AI

In the first half, Prof. Watanabe from Rissho University's Data Science Faculty spoke.

Changes in scientific methodology and its effects on present day society

Data Science can be defined as, the analysis of the current state and probably outcomes of a problem by using data, with the eventual goal of predicting the most optimal outcome and guiding the process in that direction. Various methodologies have already been studied. (Figure 1）
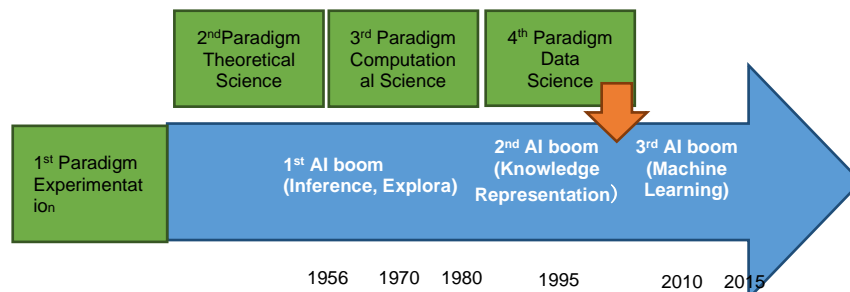

Figure 1: Research methodology paradigm shifts.[1]

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[1] Reconstructed from presentation materials

- ➢ 1st Paradigm Research & Experimentation: Building rules of thumb through small-scale experimentation, observation, and surveys.
- ➢ 2nd Paradigm Theoretical Science: Using a model using mathematical theory to create principals and axioms.
- ➢ 3rd Paradigm Computational Science: Large scale simulations using theoretical models.
- ➢ 4th Paradigm Data Science: Using large-scale data from items such as sensors and cameras as a base to create principal deviation from an engineering analysis.

It is thought that the current third AI boom was triggered by the fourth paradigm shift in the year 2000. Sensor and camera data is now being used to advance AI learning, in the future this data is expected to become more detailed and large scale. It is now possible to derive highly accurate results from the analysis of the target's environmental factors at the time of observation, the target's attributes, and the stakeholders related to the target. Against this backdrop, the Japanese government proposed Society 5.0. The government of Japan is aiming to develop this data-driven ultra-smart society by utilizing big data analytics and developing the optimal rules for its operation. The aim of this is in part to discover statistically valuable trends and associate data in both the real-world and cyberspace so that they can be applied to services in practice.

The future of human resource development in Japan

In order to realize Society5.0, people who can utilize data science correctly are needed, however, there is a shortage of these sorts of people in Japan at the moment. As the structure of data becomes more complicated there becomes a need to consider the optimal data analysis techniques and the optimal problem-solving techniques to realize data-based decision making and value creation. To achieve this people with strong data analytical skills and critical thinking techniques are necessary. In Japan, under the AI Strategy 2019[2] the following goals have been to be achieved by 2025.

- ➢ All high school graduates will have a basic knowledge and literacy of math and science, data science, and AI. In order to find and solve new problems related to society, products, and service designs cultivating creativity and problem-solving skills is essential.
- ➢ Fostering people who have an understanding of AI and data science and can apply it to their specialist fields (approximately 250,000 people per year.)

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[2] Integrated Innovation Strategy Promotion Council Decision: " AI Strategy 2019 - AI for Everyone: People, Industries, Regions and Governments- (June 11, 2019) ", https://www8.cao.go.jp/cstp/ai/aistratagy2019en.pdf
（tentative translation ）

➢ Create innovation by making full use of data science and AI to create, promote and educate globally active people (approximately 2000 people per year, with 100 executive-level people.)

➢ Implement recurring education that fosters, math, data science, and AI-ready people at work (approx. 1 million per year, including work to promote women's participation as part of this reeducation.)

➢ Promote opportunities for international students to learn about data science and AI.

In order to resolve the shortage of data scientists, it is necessary to build an education system with data utilization from primary through to tertiary education, as well as allowing opportunities for adults to periodically reeducate themselves. This is already occurring overseas.[3] In the AI strategy 2019, in addition to the above-mentioned goals, specific goals for education were specified. (Table. 1）

Table 1 Specific Objectives

Literacy Education	High school	All high school graduates (Approx. 1 million annually) are to have a basic knowledge of the science, math, and IT knowledge that form the basis of Data Science and AI. Additionally, they should have knowledge of humanities and social science, and problem identification and resolution skills aimed at new ideas for society as well as new products and services.
	University Technical college	All university students regardless of their major should acquire basic math and science, data science, and knowledge of AI in their courses. (approx. half a million students per year)
	Workforce	Providing opportunities for people (approx. 1 million people per year） to revise their basic information skills, data science skills and AI-related skills.
		Enhancing liberal arts-focused learning for university students and citizens' education. This is to encourage critical thinking skills so that citizens do not fall behind the technological curve of AI and data analytics.
	Elementary and middle school	Regarding basic math and sciences fields needed for data science and AI. ① Maintaining and improving the current level to keep world leader status. ② Improve the level of interest in science and math which is low when compared with the global average. Additionally, promote opportunities to understand how science and math are related to

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[3] From April 2021 in the United Kingdom government began its Lifetime Skills Guarantee program to promote these skills.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/976190/DfE_Lifetime_Skills_Guarantee_Announcement_-_Provider_Communications_Toolkit_April_21.pdf

		society.
Fundamental Education		Regardless of major, having students from major universities and training colleges acquire basic skills in how math data science and AI can be applied to their fields (approx. 250 thousand people annually) In order to do this universities which promote skills in math, science, data science and AI should be supported.
		Fostering a workforce that can use AI to solve regional problems (1 million people per annum)
Expert Education		Training experts and creating an environment where they can demonstrate and develop their skills to promote innovation. (Approx. 2000 people with 100 top-ranked population per year.)
Mathematics, Science, Data science and AI education, and certification program		Establish and promote a system where the government recognizes educational excellence in university and technical colleges for AI, math, and data science programs.
		Promote government-certified programs in AI, math, science, and data science.

The "AI strategy 2019", refers not only to primary and secondary education but also to tertiary education and recurrent[4] education. In the future is expected that guidelines for adult education will also be established.

3. The future social Implementation, DX in organizations and human resource development

In the second half, Mr. Koizumi from the Digital Literacy Council spoke on The Future Social Implementation, DX in Organizations and Human Resource Development.

Current situation of workers

The procuring and education of people with DX skills in organizations is also an investment each organization should carry out to achieve the organization's professional development goals. The government is also considering the future of the workforce listing skilled professionals as part of its AI strategy, particularly as part of education reforms.

Through these strategies, the government attaches great importance to solving the AI skills shortage and is calling for further education reforms. At the moment one of the causes of shortages is centered around educational methodology problems. The traditional lecture-style format of teaching is seen as being insufficient for learning. Additionally for rapidly changing fields like AI, continuous updating of the curriculum is required. Moreover, both theoretical and practical abilities need to be developed in

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[4] Relearning knowledge after formal education and promoting the continued professional development of people in society.
https://www.mhlw.go.jp/stf/newpage_18817.html

individuals in order to implement AI into society. Therefore, the instructor will need real-world experience in promoting the utilization of AI, naturally securing such individuals for teaching purposes will be difficult due to their scarcity and the high value of their time.

Methodology for the development of skilled workers from a DX promotion perspective.

there is an increasing need for skilled workers not merely in AI but in various technology-based areas in many companies and industries. In order to develop these skilled workers in such a rapidly changing environment, one method of education is thought to be to collate skills and experience relating to digital technology and corporate transformation, then extract the problem-solving abilities and mindsets necessary to promote the project (Figure 2). It would then be possible to develop a curriculum based on these common elements. However, there are many uncertainties surrounding this. As such it is first necessary to begin with digital literacy and other such elements, identify areas of improvement, and then act on them. This is seen as being a very sound methodology in this case.
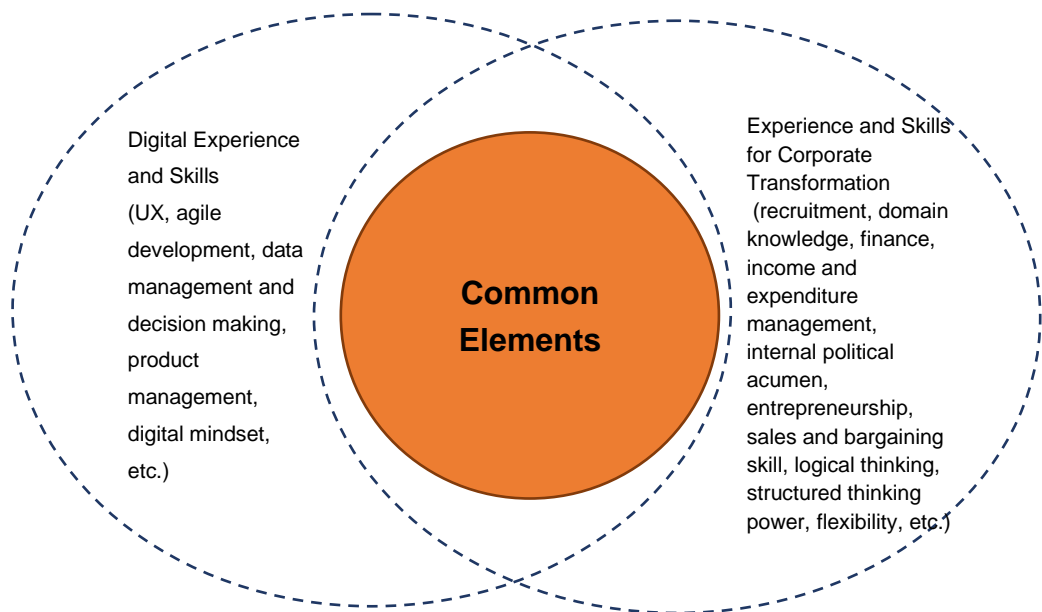
Digital Experience and Skills (UX, agile development, data management and decision making, product management, digital mindset, etc.)

Common Elements

Experience and Skills for Corporate Transformation (recruitment, domain knowledge, finance, income and expenditure management, internal political acumen, entrepreneurship, sales and bargaining skill, logical thinking, structured thinking power, flexibility, etc.)

Figure 2: Common skill and experience elements in digital and corporate transformation[5]

With the speed of change across all areas accelerating, many people other than DX's are struggling to keep social implementation up to date. One methodological solution is to implement social change using agile methods.

The Digital Literacy Council identified ideas of common literacy which all the business persons should acquire as "Di-Lite." The council aims to build a system that nurtures

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[5] Reconstructed from presentation materials

professionals and promotes the future social implementation of DX.

4. Organizer's summary of the main comments from the participants

The theme of the 5ᵗʰ session was developing skilled professionals in the field, the following questions and answers were based on this topic.

- ➤ A role model for specialists
    - ✔ There is a shortage of people skilled in data science and AI as we move towards society 5.0. While men and women should be able to participate in the field without a gap appearing, the majority of people in the industry at the moment are men in Japan. We believe that equity measures, such as gender percentage requirements may be necessary to ensure diversity. The current bias in the ratio towards men in data science and AI hampers women's advancement and success. Clarifying the role model is one way to resolve this.
- ➤ Issues and outlooks for professional development
    - ✔ Modern-day society is hard to get an overview of because it is multidimensional and multilayered. In order to do so, the problem must be looked at from multiple directions and perspectives in order to extract the important elements. It will be important for the DX to continue to share this knowledge in the future.
- ➤ Issues related to industry-education sector collaboration
    - ✔ It is necessary to appoint practically-minded experienced educators through industry-education sector collaboration so that more practical content can be provided. The program should not be biased by a single expert's point of view. Challenges and outlooks should be provided by recruiting digital specialists within companies.
- ➤ Issues related to industry-education sector collaboration for the promotion of skilled individuals.
    - ✔ While companies are hiring digital specialists, they often lack internal opportunities to make use of these people's skills. Often people familiar with the digital environment are considered to lack value-adding practical skills. This should also be considered by hiring companies when recruiting.
- ➤ DX promotion and mindset change.
    - ✔ It is essential to change organizations' mindsets about promoting DXs. When internal cooperation within an organization is low, it can be difficult to expand the utility of the DX across the organization as a whole. By promoting internal understanding and cooperation between departments, acquiring internal feedback, and promoting internal initiatives the role of the DX can successfully

proceed.

- ➢ Data analysis and the fusion of humanities.
    - ✔ While statistics and data science have been considered science fields for many years, in recent times some universities have been integrating science and humanities fields together. This means that it is conceivable that a student can be educated in humanities and the principles of data analytics producing data scientists.

The discussion of AI Governance domestically and internationally will continue through this study group.

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Translated by David Shield

＜The 5th Session of the Study Group＞

Date/Time: Friday, December 10th, 13:00-15:00（On Zoom）

Contents：

- ・Topic 1: "Data Science Education in the Age of AI" provided by Prof. Michiko Watanabe (Faculty of Data Science, Rissho University)
- ・Topic 2: "The Future Social Implementation, DX in Organizations and Human Resource Development" provided by Mr. Makoto Koizumi (Digital Literacy Council / Graduate School of System Design and Management, Keio University)
- ・Questions and Discussion