

# CONCEPT

## AI and Design Thinking for Transforming Industry and Society

### Fostering of Digital Talent by Lumada Data Science Laboratory

#### Minoru Aoshima

Fellow, Nomura Research Institute, Ltd.



#### Tatsuhiko Kagehiro

General Manager, Center for Technology Innovation – Artificial Intelligence and Lumada Data Science Laboratory, Research & Development Group, Hitachi, Ltd.

The world is said to be experiencing a time of uncertainty in which drastic changes are taking place in people's attitudes and sense of value. Amid the changing landscape of business and daily life brought about by the COVID-19 pandemic, there are calls for DX to be used to create new value and bring structural change to companies and society in order to boost the resilience of business and social systems. Based on his extensive experience in management consulting, Minoru Aoshima, a Fellow of Nomura Research Institute, Ltd., asserts the need for structural change through the application of DX to industry, especially manufacturing, also highlighting the challenges that exist for Japanese companies engaged in DX. What is needed for the successful accomplishment of business reform and structural change by means of DX? How can more people be equipped with DX skills? In what areas can there be expected to be seen new value arise out of the use of digital technology? These questions are addressed here in the form of a discussion between Mr. Aoshima and Tatsuhiko Kagehiro, head of the new Lumada Data Science Laboratory opened by Hitachi in 2020.



---

#### Eliminating Mismatches in Society

---

—At the same time as the ongoing COVID-19 pandemic is serving to advance corporate digitalization, expectations have also risen for government encouragement of digital transformation (DX), including Japan's establishment of a new Digital Agency and a growth strategy in which decarbonization and digital technology play a central role. Given that you have been involved in DX at numerous different companies, could you start by explaining the background about why DX is seen as essential for society as a whole and for industry?

**Aoshima:** DX consulting was one of my main roles as a Fellow at Nomura Research Institute and I have found

that manufacturers in particular have a high level of interest in the topic.

As to why DX is needed, when you look at it in macro terms, what you find is a society beset by a wide variety of mismatches. Taking the example of mobility, the utilization rate of private vehicles is only 4.2% in Japan and less than 10% worldwide. In other words, large numbers of people possess a vehicle they rarely use as an asset. Better use of these assets could be achieved by car sharing arrangements that match these unused vehicles with people who have somewhere they want to go.

Likewise in the energy sector, increasing the proportion of energy derived from renewables to help achieve a low-carbon society requires some means of overcoming the mismatch between the supply and demand of electricity. The use of digital technology has the potential to



**Minoru Aoshima**  
Fellow, Nomura Research Institute, Ltd.

Joining a large manufacturing company in 1988, he worked in areas such as senior management sales, commercial management of a US subsidiary, a customer relationship management (CRM) project, post-acquisition integration, and new business development. Joined Nomura Research Institute, Ltd. in 2005 and worked in the global business consulting, the technology and industry consulting, and the electrical machinery, precision engineering, and materials industry consulting departments prior to taking up his current position. He has been involved in a wide range of work for global manufacturers, including medium-term planning, business strategy, commercial reform, mergers and acquisitions strategy, and strategies for post-acquisition integration. His many publications include “Recurring Shift,” “Breakthrough by Package-Type Businesses,” “Strategy Execution Capability,” and “Creating a Business.”

bring reforms to the entire electricity system, with detailed demand prediction, use of demand response to balance supply and demand, and more efficient transmission and distribution of electric power among the possibilities.

An issue for industry as a whole, meanwhile, is the mismatch between jobs and growth opportunities and the available talent. The requirements include solutions such as human resource technology (HRTech) that utilizes data in HR strategy and management, a shift to smart factories to overcome labor shortages, and faster skills transfer.

While these issues are nothing new, it seems we have now reached a point where digital technology has advanced so far that people are increasingly asking why we can’t do something to address them.

**Kagehiro:** I think so too. While I currently serve as General Manager of both the Center for Technology Innovation – Artificial Intelligence and the Lumada Data Science Laboratory that was opened on April 1, 2020, my work since joining Hitachi has involved research in fields relating to digital technology and artificial intelligence (AI). As you know, Hitachi operates a large number of workplaces and the Research & Development Group has already been using trial and error to overcome workplace challenges by means of digital technology. Now called DX, this work has attracted more attention recently, which frankly has come as something of a surprise. However, it may be that this is because the question of how to leverage the latest digital technologies and data science to generate value in response to demand and understanding of the issues in society and industry can now be clearly defined.

---

## Industrial Applications of Image Analysis Technologies

---

—Can you give me a practical example of DX at Hitachi?

**Kagehiro:** As my original specialization was in image processing and image recognition, I will give you examples from this field. One is a collaborative creation (co-creation) with Daicel Corporation to develop a solution that uses an image processing system to analyze the behaviors of plant workers and the movement of equipment and materials to prevent mistakes before they are made.

## Recurring Revenue Business Models

Model	Description, provided value	Examples	Source of value
Fixed-price (subscription) model	Provides consumables, maintenance, or equipment operation, etc. at a fixed-price	Fixed-price ink replenishment service for printer-copiers	Value of hardware
IoT credit	Provides next-generation loan arrangements based on IoT data	Next-generation vehicle loans	
Managed service (comprehensive operation and management service)	Takes care of full outsourcing of equipment operation and management	MPS from copier manufacturer	
Payment for performance	Recovers payments from cost savings, operational efficiencies, or other such benefits, if these eventuate	Energy management performance-based compensation model	Value of software services
Industry platform	Supports customer operations extending beyond equipment Uses digital technology to facilitate digitalization across all of the customer's workflows	Smart construction	

IoT: Internet of Things MPS: managed print service

In another co-creation with Tokyu Corporation, we developed a service called Eki-Shi-Vision\* that uses images to provide information about the level of crowding at railway stations. Because of the privacy concerns that would come from using camera images directly, the service displays manipulated images in which the people who appear are replaced with icons, thereby maintaining privacy while still being easy to interpret.

We are also using co-creation for DX in various other fields, taking the customer challenges and the creation of customer value as our starting points and adopting an approach whereby we consider how we can leverage our technologies to address these.

**Aoshima:** Imaging is an extremely important factor in turning the tacit knowledge of people who work at manufacturing plants into explicit knowledge. The Daicel example has attracted attention from elsewhere in industry. If you will excuse my mentioning it here, I also discussed it in my latest book, “Recurring Shift.”

**Kagehiro:** Thank you. A feature of this technology is that cameras are one of the easiest forms of sensing to install because they can collect information from workers without getting in their way. Most applications to date have been in security and surveillance systems and I think it is fair to say

\* Eki-Shi-Vision is a registered trademark of the Tokyu Corporation.



**Tatsuhiko Kagehiro**

General Manager, Center for Technology Innovation – Artificial Intelligence and Lumada Data Science Laboratory, Research & Development Group, Hitachi, Ltd.

Joined Hitachi, Ltd. in 1994. After some time as a visiting researcher at the University of Surrey and working at the Global Center for Social Innovation, he took up his current position in 2020. He holds a doctorate in engineering. He is a visiting associate professor at the Program in Empowerment Informatics, School of Integrative and Global Majors, University of Tsukuba. He has authored numerous papers on image recognition and machine learning and holds more than 50 development patents. In 2009, he was awarded the Okochi Memorial Technology Prize by the Okochi Memorial Foundation for the development and deployment of a general-purpose recognition technique for overseas banknotes for use in banknote-recycling automated teller machines.

that only Hitachi has been able to deploy them industrially, notably for skills transfer and error prevention purposes.

### Japanese Manufacturing's Transition from Tangibles to Intangibles

— You have written about recurring revenue models in your latest book and that certainly seems to be the way things are going.

**Aoshima:** That's right, there have been many instances of companies looking to adopt business models based on recurring revenue as a way to deepen their relationships with their customers.

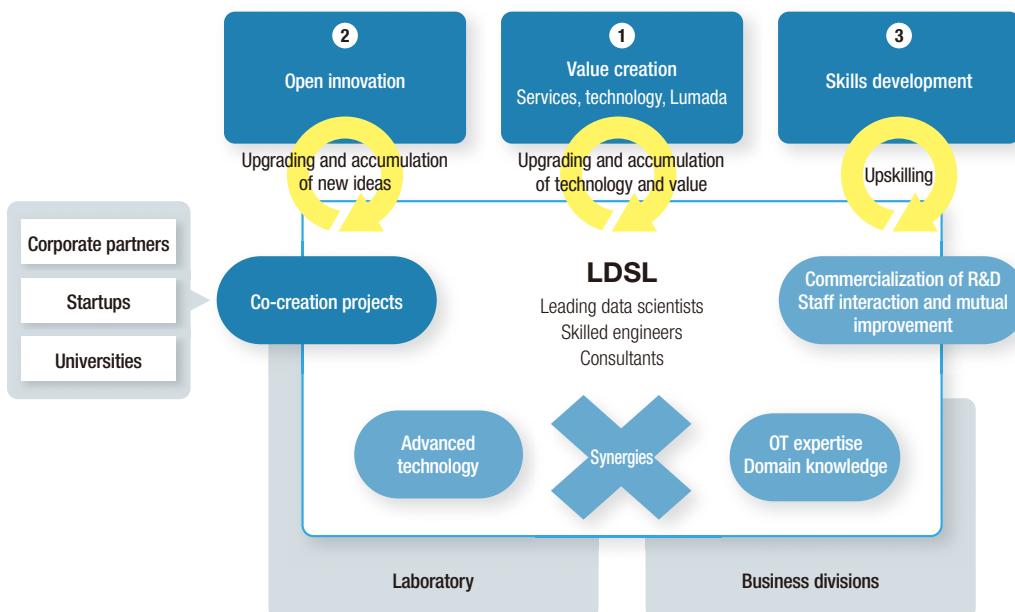
While there is a need for DX across many different industries, I am particularly hopeful about the evolution of Japanese manufacturing, especially the transition from tangibles to intangibles in their business models. That said, to go from selling compressors, for example, to instead selling compressed air is far from simple. Having in the past relied for competitiveness on the quality and value of their products, it has not been easy for Japanese manufacturers to make the shift to services and many companies have been making hard work of it. Since recurring revenue models also serve as a strategy for locking in customers, they can

be difficult to sustain if customers do not see what is being provided as essential, a need rather than a want. The question then is how to overcome this barrier.

**Kagehiro:** Hitachi has for some time been seeking to shift to recurring business models and this has in turn required that we step up co-creation with customers, it being particularly important that these be inspired by the challenges facing the customer. This led to the establishment in 2015 of the Global Center for Social Innovation in our Research & Development Group. The center works with customers to create new businesses and services like those examples I mentioned earlier. The way it goes about this is based around use of the NEXPERIENCE methodology of working with designers through a process of analyzing customer challenges, sharing a vision for how to overcome them, developing hypotheses, and then evaluating their performance. I worked there for about two years and came to appreciate how creating a frontline team within research and development that is dedicated to working with customers eases the process of linking the resources of Hitachi to the challenges those customers face.

**Aoshima:** I have also visited the Global Center for Social Innovation in Akasaka and the *Kyōsō-no-Mori* facility in Kokubunji. There is a considerable difference between, on the one hand, trying to make sales on the basis of

### Mission of Lumada Data Science Laboratory



LDSL: Lumada Data Science Laboratory R&D: research and development OT: operational technology



*Kyōsō-no-Mori's* Goal of Building Open Co-Creation Ecosystems

technology and, on the other, putting your heads together to decide what technologies are needed after first teasing out the customer's vision for what it is they want to do. There is also the potential to identify needs of which the customers themselves had been unaware, and it seems to me that this is where the difference lies between whether you can become a must-have or be no more than something the customer wants.

An important factor in the wider adoption and progress of DX is how to increase the number of people who can deal with customers directly on the frontline and identify their visions and needs. While AI experts and data scientists are clearly needed, without these customer-facing staff, the talents of your data scientists will go to waste no matter how good they are. Surprisingly many companies misunderstand what DX skills actually entail and in reality there are very few like Hitachi who have formalized methodologies and structures in place.

---

## DX is a Means, not an End

---

**Kagehiro:** While Hitachi still has some way to go, I have learned from practical experience that, as you noted, DX involving co-creation with customers does not go well unless the prerequisite skills in business, data science, and engineering are all in place. The problem is that so few people have the right business skills.

The Lumada Data Science Laboratory, of which I am General Manager, established at the *Kyōsō-no-Mori* with a staff of about 100, including researchers in AI and data analytics who are our leading data scientists, engineers with

expertise in operational technology (OT), and consultants. The Global Center for Social Innovation in Akasaka that you mentioned earlier also relocated an office to the *Kyōsō-no-Mori* so that they could work together more closely in the same building. Our aim is to rapidly and reliably deliver digital solutions that utilize Lumada by adopting a three-way approach in which the customer-facing staff identify and break down the challenges facing customers, the data scientists perform analyses and develop hypotheses, and the engineers put these into practice.

**Aoshima:** Something that became apparent to me when I visited the *Kyōsō-no-Mori* was that to create such a symbolic location also delivers benefits in terms of equating a place for fostering human resources with project development.

Something I believe is lacking in the Japan of today is design thinking. It will likely be difficult to survive the era of DX relying solely on the strengths of our technologies and workforce. While what is needed is to identify issues facing customers or wider society, to work with customers on coming up with whatever is necessary to resolve them, and to act in agile ways, there are few people in corporate Japan who have experience with that way of working. What is important, I believe, is to establish the foundations for people like this in the workforce through projects and places such as *Kyōsō-no-Mori*.

Michael Wade, a professor at the International Institute for Management Development (IMD), has sounded a warning that DX in Japan has come to be seen as an end in itself. He has noted how it is common for companies to benchmark themselves against the likes of Google and Amazon, companies with which they bear no comparison, and to go into it at only a superficial level. As Professor Wade puts it, DX is a means to an end, not an end itself, and you will never accomplish anything unless you first clarify what it is you hope to achieve. In that sense as well, I think Hitachi's methods and systems are noteworthy.

---

## Use of DX in Urban Development Based on QoL and Wellbeing

---

—We have already talked about the evolution of manufacturing and about workforce matters. In terms of the progress of DX, what would you like to see from Hitachi in the future?

**Aoshima:** One area is that of smart cities in this time of COVID-19. Things like techniques for analyzing the movements of people or services for showing people how crowded particular locations are that you mentioned earlier can also be put to use in maintaining social distancing. Looking farther into the future, to make our cities more resilient, there is a need for platforms for putting urban data to use, what have been called urban operating systems. This is another area where I believe Hitachi has much to contribute.

**Kagehiro:** Urban development is a focus of ours, featuring heavily in our research and development. In the future, rather than considerations of efficiency and economic value alone, I believe that factors such as environmental and social value, improving the quality of life (QoL) of the people who live in and use the city, and their wellbeing will also be important and we are looking into what sort of cities are needed to achieve these objectives.

**Aoshima:** Things like QoL, health, and wellbeing will be key factors in societies of the future. Something that might be relevant to this is how AI-based predictions and recommendations have now become commonplace in cyberspace whereas surprise encounters and serendipity are becoming rarer. This is true of books and of many other things, and I believe that the sort of unanticipated discoveries that cannot be found among recommendations derived from past data are a source of both enjoyment and growth. In the sense perhaps of demonstrating certain human-like attributes, whether in physical space or cyberspace, the development of an AI capable of delivering discoveries that a person would not have come across on their own poses an interesting technical challenge.



Workshop at Lumada Data Science Laboratory

**Kagehiro:** As you say, serendipity is very important. Recommendation is one of our areas of research, but because statistical accuracy and the element of surprise are in opposition to one another, it is a difficult balance to strike. Nevertheless, it would make a worthwhile topic.

---

### Revitalizing All Areas of Society through Greater Labor Flexibility

---

**Aoshima:** Another topic would be the matching of talent to requirements that we discussed at the beginning. Greater labor flexibility is an important factor in energizing society as a whole and boosting its capacity for growth. It should be possible to enhance this flexibility by first highlighting what talent is available within particular companies so that it can be deployed more dynamically, and then to clarify the skills definitions and match them to what is needed across society as whole. I understand that Hitachi Group has been shifting to job-based employment practices and boosting flexibility. I hope you will also go on to offer this in the form of solutions.

Taking it further, it would be wonderful if you were able to build AIs that can identify people's latent skills and determine job requirements, and then match one to the other, or that can suggest how to go about skills development.

**Kagehiro:** It certainly would. While skills assessment and matching are both technically feasible, a major challenge to doing so would be finding consistent ways to collate and centrally manage data on the attributes of individuals. At Hitachi Group, we are currently working on job descriptions (clarifying people's roles) and I hope we can go on to build optimal models as we operate this within the group.

— However, the deployment of AI in society in applications such as talent matching also raises ethical issues.

**Kagehiro:** As a company that works on social infrastructure, I believe we have a duty of responsibility at Hitachi with regard to what has come to be called AI ethics. As well as dealing with the technical aspects, it is also essential when deploying AI in practice to consider what to do about the social systems and services that adopt this technology,



and what impact it will have on users. Along with improving accuracy and robustness, we are also taking a variety of different approaches to technology development aimed at “trusted AI” that involves maintaining transparency and the ability to explain decisions as well as things like data management.

---

### Enhancing Environmental Value Hopes for “Industrial Symbiosis”

---

—What are the main areas of focus in your AI research and development?

**Kagehiro:** From a long-term perspective, how to coordinate multiple AIs in an optimal manner will be one of the challenges for the future. As smart cities grow in size, so too will their cyber-physical systems get larger, likely involving a number of different AIs operating in parallel. This will require policies on how to consolidate the outputs of different AIs when they generate different results, and the technologies to implement them.

As Hitachi has been working to enhance a wide variety of AI techniques that deal with things like images, natural language, and log data, ways of successfully coordinating these to achieve the best overall outcome is something that should be done in Lumada and we are looking into this at the technical level. Thinking of all the different systems, including AI, as an ecosystem, I believe achieving such a balance will be a key consideration in the creation of a “super smart society.”

**Aoshima:** It is an idea that seems natural to Hitachi given that your activities go beyond IT and encompass a wide range of businesses. I hope to see you tackling areas such as industrial symbiosis, a term that has much in common

with ecosystems. Symbiosis is about a mutualistic existence and Northern European countries such as Denmark have developed an “industrial symbiosis” whereby the waste from one company’s activities is treated as a byproduct and supplied to other companies that can use it as a fuel or feedstock. I believe that digital technology can facilitate the establishment of arrangements for identifying the existence of such byproducts and putting them to use, and I see the creation of ecosystems, in this sense of the term, as also being important for the environment and decarbonization. While this is just a personal opinion, I hope that we can create a prosperous recycling-based economy and a symbiotic society that makes common use of byproducts and other such resources in the community.

**Kagehiro:** Hitachi also places a high priority on environmental value, and while we are developing digital technologies that will help to decarbonize society, such as by providing greater clarity over how much renewable energy is used, as you say, efforts to change the very nature of society are also essential.

Along with accelerating changes in society, there is also a need to speed up the process of collaborative value creation with customers. As we are strengthening agile research and development at the Research & Development Group and directing our efforts toward using Lumada Data Science Laboratory as a hub for open innovation, I hope you will continue to provide us with your advice and support. Thank you for your time today.