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Digital Technologies for a Sustainable Future

Hitachi Solutions for Sustainable Societies Combining Design and Digital Technology

Drucker and the Japanese
Learning from "The Essential Drucker on Technology"

Yasushi Isaka

Professor, Center for Liberal Arts, Institute of Technologists and
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Peter Ferdinand Drucker continues to draw growing attention from many people, including business people around the world, as an advocate of the theory of management, and he is very popular in Japan. Drucker visited Japan more than 10 times before his death and was a keen observer of society and its youth, and he was also known for his interest in Japan. Yasushi Isaka, professor of the Center for Liberal Arts at the Institute of Technologists and co-director of the Drucker Workshop, spoke about Drucker's views of humanity, his interest in Japan, and the unique strengths of Japan that could be gleaned from his evaluation of the country.

Yasushi Isaka was born in Kazo City, Saitama Prefecture, in 1972. He graduated from the School of Political Science and Economics, Waseda University, and left the Graduate School of Humanities and Sociology, the University of Tokyo after earning credits in Socio-information and Communication. He received a doctorate in Commerce. Currently, he is a professor at the Center for Liberal Arts, Institute of Technologists. He is also co-director of the Drucker Workshop and a researcher at the Ishibashi Tanzan Memorial Foundation. Isaka is the author of many publications, including "Peter Ferdinand Drucker—Management Concepts: Inception and Beyond" in Japanese (Bunshindo Publishing Corporation, awarded the Incentive Award by the Society for the History of Management Theories).

Prayer Room

In 2019, before the COVID-19 pandemic hit, I had the opportunity to visit the campus of Hitachi Academy Co., Ltd. in Abiko city located in Chiba, Japan. That evening, my friend of Hitachi Academy invited me to see the prayer room because it was available.

Global companies like the Hitachi Group have many people from all over the world come to Japan for training purposes. Not only many different countries and regions, but also diverse religions and ethnic groups. Of course, there are also many Muslims.

For Muslims, praying is living, and Hitachi Academy had allotted a dedicated space to these people for their needs. Upon entering the room, one cleanses one's feet with a shower. The direction of Mecca is clearly marked so that one can easily find the direction of Mecca and pray peacefully on the carpet. Moreover, combined with the scenic lakeside atmosphere, a Japanese air of purity prevails. The place is warm and clear.

When I saw the prayer room, I felt, somewhat belatedly, that I had come into contact with the essence of globalization. I thought I understood it in my head, but seeing is believing.

Among the many changes accompanying the COVID-19 pandemic, the Sustainable Development Goals (SDGs) and ways of working are among the topics of diversification. We also often hear the phrase that "people are resources."

However, as anyone of a certain age can probably guess, it has been a somewhat attractive mantra until relatively recently. Before, it was believed that if people were allowed to act according to their own ideas and leverage their individual personalities and strengths, the world would stop turning. It was thought that people could not be moved unless they were hedged in by rules and regulations. That was thought to be the case until recently.

However, the prayer room clearly expressed that diversification can indeed be a strength of Japan.

Drucker Remains Popular in Japan

Everyone knows or thinks they know the name Peter Ferdinand Drucker because of his relationship to management theory. However, the true picture of him is difficult to grasp. Although I have been researching him for more than

20 years, I have to admit that there are many things I still do not understand about him.

Then, very recently, I thought I had discovered another line of inquiry.

It is the additional question of "Why is Drucker so popular in Japan?"

In fact, there is another line of inquiry that takes an approach from the opposite direction. That is, "Why was Drucker so interested in Japan?"

Drucker visited Japan more than 10 times during his lifetime. His first visit was in 1959 in response to an enthusiastic invitation from the Nippon Omni-Management Association.

Drucker used this opportunity to keenly observe Japanese society, especially the youth. Young people are the future itself. Upon returning to the USA, he published several papers on the Japanese people. He was deeply impressed by the dedication of not only Japanese business people and industrialists, but also people in the field, and since then, he nurtured heart-warming friendships with the founders of Sony Corporation, OMRON Corporation, and other companies.

Perhaps it was through such deep relationships that he heard the name, Eiichi Shibusawa, from someone. He had always taken an extraordinary interest in Japanese art, and in his pursuit of this interest, he must have begun to deeply study modern Japanese history, especially the Meiji Restoration, and must have seen the brilliant presence of Shibusawa, who joined the new Meiji government and took charge of laying the foundations of the national economy.

This makes it somewhat clear why the Japanese people listened so attentively to what Drucker had to say and why Drucker also took a strong interest in Japan.

Why Drucker Respected Shibusawa

Eiichi Shibusawa epitomized Drucker's assessment of Japan, as a man of both practical and spiritual qualities. I think the title of Shibusawa's representative work, *Rongo to Soroban* (*the Analects of Confucius and the Abacus*), beautifully expresses the union of the two worlds of knowledge and action.

After his first visit to Japan, Drucker's writings frequently refer to Japan, and in step with this, his evaluations of Shibusawa often appear in his writings. In his key book, *Management: Tasks, Responsibilities, Practices*, he states:

"Shibusawa envisioned the professional manager first. The rise of Japan in this century to economic leadership is largely founded on Shibusawa's thought and work."

It may seem a bit exaggerated to say that Shibusawa was the first in the world to understand the need for management, but there is no doubt that he was considered one of the world's pioneers in this field.

Drucker's understanding of Shibusawa is by no means shallow. As evidence of this, we are surprised to find that the assessments of Shibusawa appearing in his writings are extremely accurate, even if the number of citations is small.

In particular, I believe that the following description found in Drucker's *The Age of Discontinuity: Guidelines to Our Changing Society* beautifully reveals Shibusawa's true nature:

"The very names of Yataro Iwasaki (1834-85) and Eiichi Shibusawa (1840-1931) are known outside Japan to only a few specialists. Yet their achievements were a good deal more spectacular than those of Rothschild, Morgan, Krupp, or Rockefeller. Iwasaki founded and built the Mitsubishi group of industries – to this day the largest manufacturing complex in Japan and one of the world's largest and most successful business groups. Shibusawa founded and built more than 600 industrial companies during his ninety years of life, … . Between them, these two men founded something like two-thirds of Japan's enterprises in manufacturing and transportation. No other two men in any economy have had a similar impact. And for twenty years, until Iwasaki's early death at age 51, these two men engaged in a public and often acrimonious debate. 'Maximize profits,' said Iwasaki. 'Maximize talents,' said Shibusawa."

What do you think? Drucker clearly indicated which side he sympathized with in the last sentence: "'Maximize profits,' said Iwasaki. 'Maximize talents,' said Shibusawa."

Such a view of Shibusawa's life may be seen as overlapping with Drucker's high expectations for Japan. What is particularly important in evaluating Shibusawa is not only his great achievements, but also his mindset, that is, the way he viewed management as a position of responsibility and professionalism.

The "profess" in "professional" means a confession of faith in God. Faith is for all intents and purposes an individual thing. We are not forced by anyone, but act solemnly and accept responsibility for our actions. It is no wonder that Shibusawa, the author of *Rongo to Soroban*, was seen as the epitome of a truly dignified professional.

Of course, companies make profits by producing and distributing goods and services. However, as the central organizations of society, they are seen as ideological and spiritual entities that should contribute to the continuation and development of civilization. I think that this raises issues that still resonate in our hearts today.

Drucker continued to single out Shibusawa as one of the "Great Men of Meiji" even late in his life.

Japanese Art Connoisseur

As I mentioned earlier, Drucker was also known as a connoisseur of Japanese art.

Since his first visit to Japan in 1959, when he purchased two Japanese paintings, he was an avid collector of Japanese works of art. He amassed most of the works in his collection in the 1960s and 1970s, but he continued building his collection until the mid-1980s.

While there are works by well-known artists such as Sesshu, Sesson, and Korin Ogata, there are also many works selected with his unique eye for beauty. Tomoko Matsuo, the curator who organized the exhibition at the Chiba City Museum of Art, noted that the Drucker Collection contains a number of works by obscure Muromachi ink painters whose works are rarely found elsewhere and can only be seen in this collection. She added that the monochromatic scenes may not look spectacular to today's eyes, but they exude a sense of life and an unforgettable presence.

This assessment shows that Drucker selected the works he purchased based on his own eye for beauty, not on the artist's fame or lack thereof. In fact, many visitors to the exhibit commented that they learned about painters they did not know about before.

One-third of the works were co-called literati paintings, or *bunjinga* paintings. Drucker felt so much about the personal value of his works that he stated that, with literati paintings, you learn so much about yourself. Many of his works were on the subject of spiritual beings, such as gods and Buddha, poets, and Zen patriarchs, and were collected especially in the latter half of his life.

However, collecting them was not the purpose in itself, but rather, since almost all of them were hanging scrolls, they were used for casual appreciation as a part of daily life by hanging them nearby. He actually hung them in his study, and through gazing at them, he was able to adjust the center of gravity of his mind and cultivate his discerning vision, which was his best weapon.

Knowledge Is within Humans

The fact that he was an outstanding lover of the arts as well as management indicates that he had a keen instinct. This is also evident in his view of human beings.

Drucker's concept of the knowledge society is also well known today. This is also an indication that he saw the central figure of the next society as the knowledge worker.

However, what he meant by a knowledge worker is slightly different from the classical expression of an intellectual. Classically, intellectuals are thought of as doctors, lawyers, university professors, and other highly specialized people, but the knowledge workers that Drucker refers to are seemingly ordinary people. Yet they apply their knowledge in unusual ways to seemingly mundane objects and achieve outstanding results. Even if they are in traditional fields such as agriculture, fisheries, logistics, or retail, they still hold the reins of knowledge. Uber, Amazon, and Google, for example, while the basic needs themselves have existed for a long time, have achieved immeasurable excellence through the brilliant use of knowledge.

Knowledge workers are, to paraphrase a favorite Japanese term, intellectuals with "field" experience. Drucker also called such people "technologists." The world today is full of technologists. In his later years, Drucker was fond of pointing out the fact that technologists have become the bearers of the modern knowledge society.

As is true for technologists, ultimately, knowledge is something that humans hold. What is in your PC or phone is information, no matter how advanced it may be. Only humans can convert it into productive knowledge. If that is so, then the challenge is how to use the knowledge we have for the benefit of human society. That development is called innovation. Because knowledge is a spiritual resource, it has unlimited potential and applicability, unlike a physical resource.

And another thing, knowledge is responsibility. This is a key point of contention that Drucker always pointed out. Doctors have a doctor's responsibility, lawyers have a lawyer's responsibility, and teachers have a teacher's responsibility. They are granted responsibilities along with the authority that comes with the exercise of knowledge. That responsibility includes ethics, of course, and sometimes even aesthetics.

As professionals, we do not do things because others tell us to do so. For all intents and purposes, we use knowledge under our own responsibility. Nor do we act for the company's boss. Even if we are increasingly telecommuting and working out of sight of our supervisor, we must do our best as professionals, whether he or she is watching us or not. Sometimes, even if the boss tells us to do something, we must be able to say "no" on our own judgment if it is clearly detrimental to the world.

This is the responsibility of the knowledgeable worker.

On May 7, 2005, the author visited Drucker at his home in Claremont, California USA, and interviewed him in his last days.

Drucker's Final Message

There are many people in Japan who study Drucker and implement his teachings. What differentiates me from many of them is that I have actually met Drucker in person. It is probably quite rare for someone my age to have met Drucker.

On May 7, 2005, during Drucker's final days, I had the privilege of interviewing him at his home in Claremont, California. I can say this now, but it was truly miraculous. The more time that passes, the more grateful I am that he devoted this precious time to me with what little time he had left. Six months later, Drucker died.

The subject of that interview became the topic of "The Essential Drucker on Technology." I would like to pass on some words that he said.

Drucker said that Japan succeeded in Japanizing the West even at the opening of the country to the West during the Meiji era. Even after World War II, the country successfully underwent a Japanized reconstruction. It was not a case of the Westernization of Japan, but of the "Japanization of the West." (Interview, May 7, 2005).

This clearly shows that Drucker saw Japan as a model. He was looking at Eiichi Shibusawa and other pioneers of the Meiji era, and the entrepreneurs who were responsible for postwar reconstruction. In their actions, there are hints as to how Japan's strengths should be used for the benefit of the world.

When we hear of the Japanization of the West, we feel it is exaggerated, and even feel a little uncomfortable. However, we must solemnly accept that this was Drucker's final conclusion after studying Japanese culture.

If we take this step, I feel that, just as our predecessors in the Meiji era succeeded in "Japanizing the West," it is now time to "Japanize the global world." And just like Hitachi Academy's prayer room introduced at the beginning of this article, we will envelope the global and diverse world with Japanese fortitude and sensitivity.

This perspective seems unlikely. We should be more and more amazed by the cultures and qualities that we are surrounded by in everyday life. The intelligence to sense the "uncommon" that lies within the "commonplace" is now in demand.

Even today, there seems to be no end to what we can learn from Drucker.

Digital Technologies for a Sustainable Future

Hitachi Solutions for Sustainable Societies Combining Design and Digital Technology

Both business and the public are facing rising uncertainties, with climate change and other environmental problems being accompanied by increasing geopolitical risk. Amid calls for society to achieve sustainable growth without sacrificing people's quality of life (QoL), Hitachi has been leveraging the capabilities of GlobalLogic Inc. (a company that joined the Hitachi Group in July 2021) to pick up the pace of its various initiatives that use design and engineering to reform social infrastructure.

This issue of *Hitachi Review* focuses on digital engineering for sustainable societies, presenting examples of where co-creation has been used to generate new value as well as articles describing Hitachi's distinctive co-creation processes and the digital technologies that underpin them.

MESSAGE

Hitachi's Pursuit of a Sustainable Society

Leveraging Digital Technology to Lead Customer and Societal DX

Toshiaki Tokunaga

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General Manager of Digital Systems & Services Division,
Hitachi, Ltd.

Boosting Agility to Become a Global Digital Company

The environment surrounding societies and companies is changing rapidly due to extreme weather conditions, natural disasters, pandemics, and geopolitical risks that are occurring in various parts of the world. Confronted by a diverse range of increasingly complex challenges, not the least of which are climate change, aging social infrastructure, and the rising incidence of cyberattacks, digital transformation (DX) is accelerating globally to reform companies and societies.

Hitachi aims to realize a sustainable society through the use of data while incorporating cutting-edge technologies such as Web 3.0 and the metaverse. By pushing ahead with its Social Innovation Business based around the pillars of "Green, Digital, and Innovation," Hitachi is playing its part in realizing a society that combines human wellbeing with a healthy global environment. Lumada is the driving force behind this social innovation business.

To accelerate the global growth of Lumada, Hitachi launched Hitachi Digital LLC in April 2022. The company is based in North America where the DX business is growing rapidly. Hitachi is also pursuing a group-wide global digital strategy, including the strengthening of collaboration between the new group company, GlobalLogic Inc. (acquired in July 2021) and other Hitachi companies, including Hitachi Vantara LLC, Hitachi Energy Ltd., and Hitachi Rail Ltd. For the Japanese market, where DX business is expected to grow, GlobalLogic Japan, Ltd. has been established to accelerate customers' DX initiatives based on Hitachi's strong customer base and GlobalLogic's design-driven digital engineering capabilities. Through these initiatives, Hitachi will enhance its "agility" and strengthen its digital business globally, driving Lumada business expansion and growth through DX, and achieving its transformation into a global digital company.

Expansion of Lumada Business to Accelerate DX in Customer Business Systems and Social Infrastructure

The Social Innovation Business starts with an understanding of social issues and customer issues, then designs and

Lumada's Growth Cycle

By leveraging the collaborative creation and digital engineering capabilities of GlobalLogic together with Hitachi products and services and its skills in mission-critical system development, Lumada provides support for each step in the cycle of overcoming customer challenges.

implements solutions, and then cycles through operation and maintenance to solve social issues and increase customer value. The first step in this Lumada's growth cycle involves the use of design thinking to identify the issues of concern. The next step is to use the cloud or other platforms to build the systems that will resolve these issues. The third is to expand and enhance functionality, such as by linking the new systems with other products to track operating conditions. In the fourth step, the system operation is advanced so that customers can focus on their own business, and at the same time, the collected operational data is analyzed to discover new issues and lead to solutions.

In acquiring GlobalLogic's design and digital engineering capabilities, Hitachi is now able to understand customers and social issues in the global DX market and develop solutions more quickly by combining its strengths in operational technology (OT), IT, and products. Hitachi Vantara can then implement these solutions developed by GlobalLogic in the cloud and make them available as services to global customers. Another benefit of this approach is that it leads to recurring business.

To further accelerate DX both at customers and within Hitachi Group, Hitachi has consolidated domestic and international consulting, design, and digital engineering functions, including GlobalLogic, and established a new Digital Engineering Business Unit in April 2023. By working with other business units to accelerate the Lumada's growth cycle, this will further expand the Social Innovation Business of developing solutions and generating new value for customers and society. In the hybrid cloud and other

areas of the rapidly growing cloud business, Hitachi is seeking to enhance the competitiveness of its global cloud service and data management business, both through the further development of Hitachi Vantara's strengths in data management and storage solutions and by leveraging its expertise in mission-critical systems and IT platforms.

Strengthening and expanding digital human resources is essential for expanding the Lumada business. Along with continuing to advance the excellent talent recruitment and development schemes at GlobalLogic, Hitachi also intends to deploy them in Japan to upgrade its own staff development programs. By expanding the exchange of personnel with GlobalLogic, Hitachi plans to strengthen its development of digital talent and expand its international workforce of people with skills in this area to around 30,000 by FY2024.

This issue of *Hitachi Review* focuses on digital engineering, presenting examples of where collaborative creation has been used to generate new value as well as articles describing collaborative creation processes and the digital technologies that underpin them. Hitachi will contribute to the realization of a sustainable society by leading DX for customers' business systems and social infrastructure.

TRENDS

Digital Technology Is More than Just a Tool

Keita Nishiyama

Visiting Professor, Institute for Future Initiatives, the University of Tokyo
Senior Executive Fellow, Industrial Growth Platform, Inc.

Digital Technology Will Change Organizational Principles

It has already been several years since the term digital transformation (DX) became popular. When I published my book on DX in 2021, some people told me that DX might be just another buzzword, and therefore, no one would be mentioning it anymore after the new year. But they were mistaken.

Why? Because digital technology is more than just a tool.

People often say, "digital technology is just a tool and nothing more." I can understand their sentiment. They mean that digital technology itself or the use of digital technology is not the realization of the values that society and individuals are aiming for. However, I have a somewhat different opinion.

This is because realizing DX by making the best use of digital technology is inextricably linked to changing the existing organizational principles of companies and society. And the degree of change required is significant in Japan. This is precisely the reason why we use the term "transformation." If digital technology were to drastically change the structures of organizations and the way we work,

we would certainly not consider it as just a tool. But why do digital technologies change organizational principles?

Digital technology has certain characteristics. It exhibits a structure consisting of multiple horizontal layers. The idea of a 'computer' came from the inspiration that it would be possible to solve mathematical problems not one by one, but by finding a methodology to solve those problems. Likewise, the developed digital technologies were not directly linked to specific applications, such as the development of vaccines, the provision of new financial products, or beating Go masters. (They can help overcome such challenges when applied.)

What is astonishing about ChatGPT* is that it can handle any conversation (even a professional one) with anyone by learning enormous amounts of data using a training model that incorporates a huge number of parameters. Of course, there is still much that it cannot handle, and there are also risks. But the important thing here is that an artificial and transversal training model, whose design is unrelated to any specific discipline, is now performing intelligent tasks, including those that, up until now, we have assumed only experts with highly specialized knowledge could address. These artificial intelligence (AI) models are

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* ChatGPT is a trademark or registered trademark of OpenAI, L.P.

also called 'foundation models' to emphasize their cross-disciplinary and infrastructural nature.

Hence, the key to DX is to replace the existing 'vertical' organizational principles with a horizontal layered structure. But how can this be done? We will address the issue from three angles. Abstract thinking, replacement of stove-piped models, and architecture.

Abstract thinking

In the world of business, we tend to underestimate abstract thinking as something that is detached from the reality of business. However, such a view neglects the power of abstraction. Since abstract thinking has its own depth, it is useful to appreciate it step by step.

The starting point of abstract thinking would be to simplify the subject, i.e., to express only what is essential in a straightforward manner. Adding more and more information will not give you a clue to solving problems. Problems should be simplified first. Secondly, there is more than one way to simplify. When you try to describe your business in a simple way, you will find that there are several ways of doing it. That makes you see your business from different perspectives. If you get to this point and pay attention to one of these viewpoints, you will realize the similarities between your business and apparently different types of businesses. Those who can come up with analogies with ease are good at these exercises. And here is the most important point. 'Abstraction' is often regarded as the opposite of reaching concrete solutions. But this is not correct. Abstraction is a way of thinking that unbundles an object into multiple factors and then replaces some of them with alternatives to explore something new. (Japanese-style pasta with natto and smartphones are product of these exercises.) In other words, abstraction is a way of conceiving particulars that are not with us here and now.

How can we turn silos into flat organizations?

To avoid silos and make your organizations open, you need to convert their vertical structure into a horizontal structure. But where should we start? This is a question that many DX leaders struggle with. I recommend thinking from the question of 'what are the things that are currently vertically split.' In my view, organizations are vertically split according to three aspects.

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The first is communication channels. If a staff member wants to communicate important information to the CEO, he or she is expected to communicate it through a line manager. (If you fail to comply with this, you attract unfavorable judgement from your superiors.) If you want to ask a neighboring department to do a job for your team, you are told that things should be first discussed between managers, which hampers quick action. This is the vertical division of communication. This was an efficient way of conducting business in the days without digital technology, but it is entirely different now. And if communication remains stove-piped, it is difficult to organize new teams and develop new services flexibly.

The second is the split of operating procedures. This refers to the fact that the procedures for handling work differ from company to company and department to department. In the past, procedures regarding reimbursement of travel expenses, requests for approval, accounting in general, personnel evaluation, customer management, production planning, etc., have all been devised by each department and company. However, various horizontal digital tools are now beginning to replace these unique procedures, and as one aspect of DX is mastering these tools, it is useful to think about replacing your company's unique procedures with horizontal tools.

The third is the lack of alignment between products and services. Until now, many products and services have been developed individually even within companies, not to mention across companies. Hence, they are not easily combined with each other. It was assumed that customers would devise their own combinations. It was also believed that value was created by improving the functions of individual products and services and offering a lower price through cost reductions. However, this is not the case in the digitalized world. Value is created by the seamless experiences between products and services, and profit is generated where seamless experiences are offered. Cloud service is a good example of this.

In many successful cases of DX, the company started by eliminating the communication stove pipes. This is probably because, in order to get more people actively involved in the company's DX, it is quintessential to fix communication stove-piping. Without doing so, and, for example, starting from utilizing data and AI for specific cases, they would often end up as PoCs and do not make further progress. Lacking skills and shared context among members of the organizations, the use of data tends to become a burden for the members rather than making their lives easier. This is a topic that I would like you to consider for yourselves in light of your own business.

One point should be made regarding what I mean by 'horizontal.' For example, in Japanese Government, the use of common IT systems is promoted to avoid spreading of incompatible systems of individual ministries. But there is often a misunderstanding of what we mean by 'common.' Using a common system does not mean "doing things exactly the same way across the ministries." It means standardizing the fundamentals to absorb room for adjustment in individual cases. Consider the case of the payment system of subsidies, which caused many problems and attracted attention during the COVID-19 crisis. Eligibility and the amount of benefits all differ from subsidy to subsidy. The true meaning of common systems is to look for common features even though the specific parameters may change in individual cases. Which brings us back to the topic we discussed, namely, breaking down the process of providing subsidies into layers.

Architecture

Architecture is a subject that is related to the above story. Herbert Simon, who won the Nobel Prize in Economics and the Turing Prize, wrote a paper in 1962 entitled 'The Architecture of Complexity.' His basic argument is that complex systems, while they are diverse and subject to the analysis of different disciplines, share common characteristics. (A company is a complex system.) And those characteristics can be synthesized as architecture. One of the common features of complex systems is their layered structure (Simon called it a hierarchic structure, emphasizing that the higher up in the hierarchy, the more it

corresponds to practical problems.) Simon continued his inquiry on architecture with reference to computers and AI as an embodiment of such architecture. Simon died in 2001 without witnessing the current stage of advanced AI. His thinking of architecture is becoming increasingly relevant today, with the rapid progress of AI and the permeation of digital technology across industries.

At the beginning of 2020, when I was still a government official, I asked Mr. Hiroaki Nakanishi, the Chairman of Japan Business Federation (Keidanren) at the time, to give a lecture on architecture at the seminar we organized. I received three messages from his lecture. First, architecture used to refer to a certain aspect of computers, such as the instruction set, but now it is becoming a framework for industry and society. Second, to realize it, it is necessary to change organizational principles. (He vividly conveyed this message using an example from his own experience with the railway control system.) Thirdly, Japan should take the lead in presenting the new architecture to the world. I consider these to be his will for us and hold them close to my heart. And you will also notice that the late Mr. Nakanishi's thoughts are in line with Simon's ideas.

What, then, could the complex systems representing this architecture offer to us? They provide customized solutions to a variety of problems and meet unique demands, although the mechanisms are common. Hence, architecture is closely related to the realization of diversity and inclusion. When it comes to 'diversity' and 'inclusion', many companies set these as their goals. And this is another reason why I believe that digital technology is more than just a tool.

ACTIVITIES 1

Benefitting Society with Value Created through Digital Technology

How Hitachi Digital is Working to Combine Sustainability and QoL

Jun Taniguchi

CEO, Hitachi Digital LLC

The Mid-term Management Plan 2024 published by Hitachi, Ltd. in April 2022 described a growth strategy driven by digital business, with Lumada playing a central role. To achieve this and accelerate digital business activities across group companies worldwide, Hitachi Digital LLC, a company established that same month, is pursuing a global digital strategy it devised for Hitachi while also strengthening its collaboration with other group companies. For this article, *Hitachi Review* spoke to Hitachi Digital CEO, Jun Taniguchi, about why the company was established, what role it will play, and its partnership with GlobalLogic Inc., a company that became part of the Hitachi Group in 2021.

Collaboration between Business Units Essential to Global Expansion of Lumada Business

Hitachi Digital was established in April 2022 to formulate and execute a global digital strategy for the entire Hitachi Group. Please tell us about why the company was established and the role that it will play.

In our Mid-term Management Plan 2024, Hitachi set a goal of becoming "a global leader in Social Innovation Business," announcing a further acceleration in our Social Innovation Business based around the three pillars of "Green, Digital, and Innovation." In the world of today where customers and wider society are experiencing rapidly changing conditions, it is important for Hitachi to clearly identify the business sectors we intend to focus on, especially in our digital business. Hitachi has a track record of supplying reliable and high-quality social infrastructure. That is a major strength for us and our intention is to continue focusing on this field while also utilizing our digital capabilities to provide better user experiences.

On the other hand, what marks out the digital business is that even more value can be created by combining expertise in different areas like design, engineering, products, and managed services. What customers are looking for from Hitachi is that we generate synergies by drawing on these various forms of expertise. To achieve this, we need to create new value by developing digital business strategies that span our many different business units (BUs). A key role of Hitachi Digital is to lead this value creation process while using Lumada as a platform. In that regard, we also serve as a control tower for accelerating the global deployment of Lumada.

How did you feel about being appointed CEO?

I felt a very heavy responsibility. This is because Hitachi's growth depends on how well this company functions. We need to break out of the existing practice whereby each BU has managed its duties with a spirit of autonomy and self-reliance. That is to say, we need to overturn accepted wisdom. I don't imagine that this will happen easily. On the other hand, it is an opportunity for me to draw on

Jun Taniguchi

CEO, Hitachi Digital LLC
Joined Hitachi, Ltd. in 1995. He was appointed President, Hitachi Global Life Solutions, Ltd. in April 2019, Vice President and Executive Officer, Hitachi, Ltd., COO of the Services & Platforms Business Unit, and CEO of Hitachi Digital LLC in April 2022. He became CEO of the Digital Engineering Business Unit and CEO of Hitachi Digital LLC in April 2023.

my own experience in business creation and in our IT, operational technology (OT), and product businesses and management. Although it is an onerous responsibility, I am committed to promoting growth based on an appreciation of the viewpoints of the different BUs that draws on my own experience.

It has been the practice at Hitachi in the past also to create new value through different BUs working together in ways that give Lumada a core role. Is it your intention to strengthen this approach on a more global basis?

Yes, it is. One of the big changes we made in FY2021 was bringing onboard GlobalLogic Inc., a leader in design-driven digital engineering. With the addition of ABB's power grid business (now Hitachi Energy), which has the world's top-class technology and market share, to the Group in 2020, there has already been a move to spread the Lumada business globally, and we will further accelerate this trend with GlobalLogic.

To achieve this, we need more than ever before to focus our energy on creating value for customers without being caught up in the demarcations between BUs. One specific measure aimed at doing so is a review of how we handle assessment, something that has become a bottleneck for BUs working together. Whereas past practice was for each BU to set its own targets and assess how well they were achieved, we are now developing practices whereby we will make a point of also assessing the outcomes of work undertaken on the basis of cooperative and collaborative arrangements between different BUs. By demonstrating such a new management mechanism, I believe that the

entire Hitachi Group will develop a mindset of providing greater value to customers than ever before.

Why base the business in Silicon Valley?

Why did you choose to base Hitachi Digital in North America?

As our target is the rapidly growing global digital transformation (DX) market, we felt that it made sense to locate ourselves in North America where the market is particularly large. As you know, North America is recognized as a market where the pace of technology is fast and where solutions advance and evolve at a rapid rate. Our aim is to adopt the best practices from this market as we expand and operate our Lumada business.

It has been already more than 10 months or so since I relocated in my role as Chief Executive Officer (CEO) and I have been really enjoying my work. The west coast of the USA is where specialists from many different parts of the world congregate, with a deeply rooted culture of resolving the concerns of customers and wider society alongside mutual understanding and respect for people's different value systems. As Silicon Valley is also a hub for world-leading technology, the many opportunities to encounter such technologies adds to the attraction.

So, you get to engage with a wide variety of venture companies and other businesses?

Yes, that is right. At the University of California, Irvine last fall, I had the chance to meet with leaders from academia

and from companies that are a global driving force in digital business. One of the things that sets Silicon Valley apart from other areas is the relative ease of communicating with people who play leading roles in digital technology globally.

Another key consideration in our choosing to base ourselves in North America is that digital capabilities are of overwhelming importance to Hitachi as we seek to become a global leader in social innovation. In our activities that use IT to integrate OT with products and deliver value in ways that are distinctive to Hitachi, basing ourselves in the international hot spot that is Silicon Valley is a statement of intent on our part, indicating the even greater effort we intend to put into the digital field.

Role and Expectations for GlobalLogic

As you mentioned before, GlobalLogic became part of Hitachi in July 2021. Given that the idea is to combine the capabilities of GlobalLogic with Lumada to supply fully featured digital solutions globally, what specific expectations do you have for the company?

In a word, I want it to serve as a trigger for transforming the culture and business model of Hitachi. At the same time, I also believe that a very strong affinity exists between Hitachi and the culture at GlobalLogic. I got together with several dozen of the leaders at GlobalLogic shortly after being appointed CEO in April 2022 to discuss the company's strengths and the wellsprings of its growth. While they expressed its strengths in different ways, all agreed

on the three common elements of: (1) mutual respect; (2) customer success first; and (3) early challenge, failure, and learning. I immediately realized that these were the same as Hitachi's own "harmony, sincerity, and pioneering spirit."

The first, mutual respect, is particularly important here. Moreover, respect depends, first of all, on having a good knowledge of each other. I believe that respect and deference come about only when, for example, you have knowledge of products and technologies, when you have knowledge of the customer's business, when you have domain knowledge, and when you have a deep knowledge of the other person. It is by having mutual understanding and respect that people are able to come together as a team and quickly get down to the task of creating new value with a shared sense of purpose. That culture already exists in Hitachi and I believe it will be a key growth driver when it comes to achieving a major expansion in our Lumada business.

On the other hand, whereas mission-critical solutions are a key strength for Hitachi, the competencies of GlobalLogic are in agile development and value creation. By combining and complementing our respective capabilities, we should be able to thrive in this era of uncertainty.

Similarly, GlobalLogic's culture of taking on challenges and learning from failure equates directly to the Hitachi tradition of "pioneering spirit" and to our "*Ochibo-Hiroi* (gleaning) practices." I have great expectations for GlobalLogic in this regard as well, as I also feel that the spirit of learning from failure has weakened a bit in the process of Hitachi's growth. In any case, by Hitachi working with GlobalLogic, I look forward to our establishing a culture of growth and taking on new challenges with respect for one another.

What impression do you think GlobalLogic employees have gained of Hitachi and Lumada?

They have shown real understanding. First of all, they recognize the great potential that exists in Hitachi's experience and reliability when it comes to taking on mission-critical applications through Lumada and other businesses. As involvement in our Social Innovation Business greatly expands the scope of GlobalLogic's business, the employees too have high expectations for the arrangement. This sense of expectation and excitement is also evident in our daily conversations.

Another factor is that the employees recognize how planetary boundaries are key indicators and share Hitachi's commitment to contributing to the lifestyles and wellbeing of people around the world. As the average age of staff at GlobalLogic is young, at only 28, they have even greater enthusiasm than our generation when it comes to appreciating the importance of protecting the global environment and of contributing to society.

Has the presence of GlobalLogic already started changing the culture or business models at Hitachi?

Yes, it has. The work that GlobalLogic is already doing with a number of BUs and group companies is bringing their respective cultures closer together. In October 2022, Hitachi Digital and GlobalLogic jointly hosted the Hitachi Digital Summit in San Francisco. The event brought together 150 people, mainly GlobalLogic staff along with CEOs and other C-suite executives from various Hitachi BUs and group companies. The in-depth discussions that took place included the sharing of successful DX use cases. I believe that activities like this are giving rise to positive change, providing opportunities for customer-facing staff at Hitachi BUs to be exposed to GlobalLogic's digital engineering and design practices and to appreciate their culture and sense of agility.

Prioritizing Energy, Mobility, and Finance Industries

What sorts of collaborative creation activities is Hitachi Digital planning with group companies like GlobalLogic or with other stakeholders such as customers from other sectors or different industries?

The Lumada's growth cycle equates to the customers' own growth processes and, for Hitachi, represents our go-to-market (GTM) strategy. For Hitachi itself to grow by partnering in the growth of our customers, the key prerequisite, as I spoke of earlier, is the delivery of value to customers from across our many BUs. Having identified growth markets, what we need to do, I believe, is to work collectively on GTM and service delivery, with GlobalLogic contributing its digital engineering, the Digital Systems & Services Division contributing system

integration, and the BUs that deal with OT and products contributing their connected products.

What specific business areas do you have in mind?

When I talk to sales and marketing, they tell me that the industries where Hitachi can create even greater value include energy, mobility, and finance. A key factor when thinking about customer value is the question of how we can combine Hitachi's digital, OT, and product technologies to create unique, new forms of value. In addition to having already launched a new mobility-as-a-service (MaaS) business in partnership with the Railway Systems Business Unit and GlobalLogic, a number of other joint projects are also getting underway. Expanding initiatives like these is another important role for Hitachi Digital. Bringing the right people together and establishing a structure for each project or business, and then supporting its operations: this is what Hitachi Digital is here to do.

The digital field is characterized by the ongoing emergence of new generations of technology. Are there any technologies in particular that have attracted your attention when it comes to DX?

Yes. I am very interested in Web 3.0 and non-fungible tokens (NFTs). The availability of technologies like digital twins is opening up new realms by lowering the barriers between the virtual and the real. Ease of replication is both the great advantage of digital technology and a major challenge, making it a critical issue when it comes to protecting rights in their different forms. With this in mind, I see the potential for Web 3.0 and NFTs to become core technologies that broaden the scope of the virtual realm in ways that include improving privacy and enhancing security, thereby expanding opportunities for digital business.

Digital technology is essential to many different aspects of industry and people's lives. My hope is that we will be able to contribute to the creation of new value by paying close attention to these new digital technologies and by bringing different fields together while also identifying those business sectors where Hitachi can leverage its strengths.

ACTIVITIES 2

Promoting DX to Achieve Growth together with Customers
Overcoming the Challenges of Global Co-creation

GlobalLogic, a leading company in the digital engineering industry, joined the Hitachi Group in July 2021. Since then, Hitachi and GlobalLogic have been steadily integrating their respective strengths and working on DX for both customers and Hitachi itself. Why is digital engineering so important for promoting DX? In this article, key Hitachi people speak with Rohitash Singh, Senior Vice President of GlobalLogic.

Design and Digital Engineering Underpinning DX

Singh: We, GlobalLogic, joined Hitachi Group in July 2021 and we have started co-creation activities to achieve digital transformation (DX) in Hitachi Group companies and business units, as well as their customers, while trying to achieve our growth. I lead our CTO Office, Advisory, Practices, Solutioning (CAPS) organization at GlobalLogic at our headquarters in San Jose. I do not have a lot of experience in Japan, but to set up a team here in Japan, I have learned and have taken part in some customer conversations. It is a very interesting society and a very interesting customer base as well.

Narumi: I joined the team for the initiation phase of GlobalLogic Japan, which was established in April 2021, and I am currently working on that as a project manager mainly to serve customers. Hitachi, Ltd. is supporting GlobalLogic Japan with project execution and sales activities. Data & Design and the Lumada Innovation Hub Tokyo (LIHT) members also support GlobalLogic Japan in the advisory phase[1]. For example, Mr. Kowata from Data & Design is a designer and he joins us at the very beginning

*1 A kind of idealization phase with the customer on what goals should be achieved in the design engineering process.

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Yasuyuki Kowata
Design Studio, Data & Design, Digital Engineering Business Unit, Hitachi, Ltd.

of the project and then in making a concrete plan and in work activities for the project. And on the other hand, I watch over the entire process and manage the GlobalLogic Japan team members, including onsite and offsite team members, client's expectations, and actual deliverables. That is the global team of Hitachi and GlobalLogic, which is creating and providing value to customers.

Kowata: I am working as a design strategist in the Design Studio of Data & Design in Hitachi. Actually, I recently joined Hitachi last October and, before that, I bridged the Japanese clients and designers, and also the global designers, and have worked as a consultant to identify the client challenges and then make proposals and plans. In many cases, it is really difficult for Japanese clients to identify their challenges. There are so many siloed organizations and also really limited communication on the client side. Why do they have to work on DX? Why is digital engineering important to promote DX? We need to provide these kinds of clarifications.

Narumi: The first question we address is why digital engineering is important to promote DX. One reason is that digital engineering is a very agile, iterative process. In digital engineering, we provide a clear picture of how to approach the customer challenges or the market needs in design processes while taking feedback from the market or the customer and reflecting that in products or ideas in engineering processes. With this cycle, customers can speedily invest in new business ideas or concepts while minimizing costs.

Kowata: We have two major elements in digital engineering; design and engineering. However, the design team and the engineering team are usually divided. In the collaboration with GlobalLogic, it is important that both Hitachi and GlobalLogic provide their own experience and knowledge to bridge this kind of divide.

Singh: You are right. We acquired METHOD, the strategic design arm, back in 2011, and we spent six years to integrate the design people to work together with the engineering people, and then the data people as well.

How to drive growth with our customers is about two things. The first is to make the existing set of products and services better and more sticky. Second, DX lets the customer launch new products and services, which they otherwise could not have. For example, Hilti, a manufacturer of tools, transformed itself into a different kind of digital business with asset management and leasing. Pearson, which used to be a book publisher, transformed their whole business into a learning platform. Those are the two major examples of how DX can drive growth for customers.

However, we need to be careful about how we use the term DX, because it means different things to different companies based on where they are in their lifecycle. What we can do is to make sure we talk with the customers, understanding where they are, give them ideas, and then try to offer an appropriate DX program for each customer. Within any industry, different companies have different views. In the same vertical you might find companies that are forward thinking and advanced in their thinking, and then you might find companies that are much more traditional and not willing to make the change. It is important to distinguish those differences in the early stages of the cycle so that we can utilize digital engineering and DX with them in the right way.

Challenges in Global Co-creation

Kowata: We have to distinguish what value the customer wants to provide to its customers, or what vision it wants to achieve in the future before starting digital engineering. However, there are also challenges to executing digital engineering with team members across the world, because it requires close communication between team members. One simple example of the challenges is the time zone difference. Finding the middle point, for example between Japan, India, and the USA is difficult. Styles of communication, such as conversations, meetings, or emails also differ depending on the country. And, as I already have mentioned, the boundaries between the engineering and design teams are still there. However, mutual understanding between all stakeholders is quite important in digital engineering. This is really challenging.

Narumi: We also have cultural differences between Japan and other foreign countries. For example, Japanese customers always expect very detailed deliverables or documents before making decisions because Japanese business culture is very consensus-based. On the other hand, US or European culture is more casual and a minimum level of information is all right to move forward. So, in order to

fill the gap with a customer's expectations, we usually ask our US or European team members to create documents. But typically, they ask "why?" Because they have different ideas about how to reach consensus on the need for detailed documentation in order to proceed with a project and the necessity of providing explanations in advance. Those differences in business culture might be a big challenge, but I would say it definitely can be solved through co-creation from now on.

Singh: We see a considerable difference of opinion between Europe and North America as well. In North America, decisions in business are usually made from the top down. Therefore, top executives can make risky decisions with a minimal amount of information. As a result, you'll find the proportion of failed projects to be very high in North America. There is a kind of North American business culture like, "Let's move forward with the risk, but we want to fail fast and then move on so that the cost of failure is not high." On the other hand, when we look at Europe, we find them to be a little bit more risk averse. Decisions are usually made in principle by top management, but it requires the support of middle management as well. What we are finding in Japan is a much more risk-averse approach. They want to understand more deeply what a decision means, what its merits/demerits are. Also, because customers have to consider budgets, we need the ability to provide more concrete estimations with less variance, even when things are undefined.

In this way there are some cultural differences between us, however, what is important is that we should be an advisor for our customers, not simply a DX executor. It is really important for us to provide sincere, candid advice and to build trust with them in order to promote DX. We have to learn more about Japanese business culture, but we would like to adapt it while changing ourselves.

Kowata: Japanese companies seem to have a weakness in identifying visions or challenges in their business. That is why we need detailed explanations or documents to reach a consensus over the processes to achieve a goal. To clearly understand what they want to do and why and how to do that, it is very important to join the project from a very early stage. Sharing highly confidential information with external companies is really challenging for Japanese companies. So building trust and communicating with C-suite members is quite important.

Singh: For that matter, I think we can leverage Hitachi's internal experience as well. Many Hitachi companies and business units are now embracing DX internally in different ways. They will certainly be a model to other Japanese customers in the next few years.

Narumi: When we have a successful model case internally at Hitachi, that might be a huge trigger to Japanese customers to think about promoting DX. Whereas US companies want to succeed before anyone else and actively seek out that possibility, many Japanese companies prefer to apply successful examples to themselves so as not to be the first to fail. They are usually very cautious, but it is the core business mindset in Japan. So, we need to improve the process instead in order to resolve that mindset.

Kowata: The same can be said of development speed. In the USA or Europe, they can backcast and practice what they have to do in the short term, middle term, and long term and then, even if product development is not enough, they try to launch it and see the results. On the other hand, as Japanese companies do not want to fail, they prefer a bottom-up process, like, "We have achieved this, so what is next?". It is quite difficult, for example, to apply new way of development such as agile engineering in that business culture.
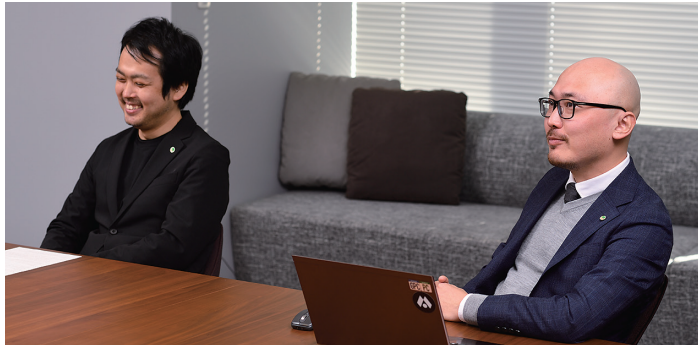
Singh: When we started working with automotive companies in Europe, because software used in automotive products must not fail to secure drivers and passengers, quality was very important, and its development lifecycle was really short. So, the challenge was how we put agile engineering into the V-model[*2]. We took a couple of years to do that, but finally were able to do it successfully. We don't have to apply it as-is, in other words, there might be ways to adapt with Japanese business practices to enable us to do agile development and design work.

Narumi: I agree. So, I think pure agile processes are a little bit hard for the Japanese market. Also, from the point of view of budgets, typically Japanese clients secure the budget a year or six months prior and they cannot invest for agile-type projects on time. In addition, as Mr. Kowata has already mentioned, Japanese clients always require super-high quality. Therefore, we should adjust our quality assurance (QA) work as well. To make extensive use of GlobalLogic's huge capabilities, I wish we could tweak pure agile methodologies just a little bit, so that we can fit them to Japanese clients.

Kowata: So, as you two mentioned, Japanese clients need a success story and there are many small teams in their organization. So I think it is quite effective to show small successes first internally with agile processes.

Educational Programs and Globalization

Narumi: By the way, I would like to ask Mr. Singh about educational programs in our organization. I think there are

*2 V-model is one of the methods used to develop the IT products, systems or software utilized in various industrial sectors including the automotive industry. It specifies how, when, and who does what in the engineering process.

also some cultural differences in terms of those.

Singh: You have to have people be cross-trained beyond their fields, especially in the IT and software industry, because technologies change very quickly. At GlobalLogic, we have the Talent 2.0 educational program with academies where we can cross-train our people. If we cross-train our people, it is easier for us to deploy them into different projects. So there are of course some business aspects to education in a company. In North America, it is very easy for companies to lay off employees who are not relevant to their business anymore. On the other hand, it is also easy for talented employees to find some other job. In that sense, a lot of responsibility is on the employees to educate themselves and keep their skills current. There is no safety net for employees to ensure their job.

Narumi: I think in Japan, there is a strong safety net which is called "*Teinen.*" If you join a company, you can work until maybe 60 years old regardless of whether you have enough skills or not. Sometimes employees feel like they are struggling to gain new skills by themselves because they cannot create a clear picture of their careers. There might be some people who find it hard to adapt to the fast-changing market or technologies. Japanese companies' educational programs can be considered as a kind of safety net for their employees so that they can easily develop their career or skills.

Kowata: In Japanese companies, where you belong to is more important. When you introduce yourself, you start with the company name first like, "I am from this company, and my name is this." But maybe in Europe or the USA, it is the opposite. This is the first time for me joining a big company like Hitachi and I have had so much training. But, I felt that much of it was not about skills and more about people management or some processes or

GlobalLogic's head office and employees located in San Jose, USA

securities which are very applicable for employees within this company only.

Also, moving between the divisions in Japanese companies really makes a big impact. For example, I worked with a client for three years, and suddenly the person in charge moved to another division. His successor did not know much about our history or collaboration with us—and then, all the projects stopped. Especially in big companies, I have heard that people have to move to new divisions every three or four years. If so, gaining skills and knowledge transfer are quite important. But there is a severe lack of time. I think that is why the superior designers or engineers do not stay in Japanese companies.

Narumi: I feel that Japanese educational programs tend to make employees generalists, not specialists. In order to become specialists, we need to outsource training by ourselves. However, GlobalLogic has thousands of specialists to give us a lot of confidence in achieving DX for customers. I think it will be great if we can learn a different mindset through educational collaboration between Hitachi and GlobalLogic, though it will not be a win-win situation immediately.

Future Vision to Promote DX in Japan

Narumi: I think collaboration between Hitachi and GlobalLogic brings great diversity to the Japanese market and customers. Diversity here means not only a difference in culture or country, but is also more about technical or business aspects. GlobalLogic has vast experience and capabilities in chip-to-cloud DX and design, and they will cover Hitachi's business capabilities to support customers, which was not enough before, and will make it possible to

deliver new value to customers in many fields of industry. Now we can do what we could not achieve very much in the past by utilizing the capabilities of both companies. We would like to utilize these new capabilities to support our customers to transform their business or improve their products/services.

Singh: In the future, we can definitely target fields in which Hitachi already has earned good respect, like energy and railway systems. If we can drive internal business transformation and convince the employees in Hitachi Group companies or business units in those field that "This is the way to achieve DX," then they can take it to their customers. I think there is enough business in just these areas if we do it well and we can expect significant growth. It is not easy to change a way of doing business that has existed for decades, so it is important for us to find the places where change is already coming and support the change.

Kowata: I agree with you. DX at Hitachi is quite important as it is said that digital consultancy companies should do consultancy for themselves. So we have to do that from our side first, and then realize good success stories and provide them to customers by having conversations with them and gaining their trust. Now, some Hitachi teams are learning from GlobalLogic, gaining extensive experience in global activities and advanced digital engineering technologies, but we have to be able to do it by ourselves, and then bridge GlobalLogic and customers to provide new capabilities. To achieve this mid-term goal, we would like to continue our co-creation activities.

ACTIVITIES 3

Driving Digital Transformation in Japanese Market through Co-creation by DX Specialists

Partnership between GlobalLogic and Lumada Innovation Hub Tokyo

Hidenori Akatoki   **Takuya Akashi**   **Naotaka Kumagawa**

GlobalLogic Japan was established in April 2022. The work of the company is to investigate and implement team structure and processes that will enable customers in Japan to accelerate their digital businesses and pursue DX successfully. This article describes the team structure and processes that combine the innovative knowledge and methodologies of GlobalLogic, a leader in design-led digital engineering, with the extensive business track record of Hitachi, Ltd., and the business understanding and experience that the DX specialists at Lumada Innovation Hub Tokyo have in working with customers in Japan.

Establishment of GlobalLogic Japan

GlobalLogic Japan, Ltd. (GL Japan) was established in April 2022 to play a leading role in design-led digital engineering for customers in the Japanese market[1].

GL Japan has office at the Lumada Innovation Hub Tokyo (LIHT). It works on digital transformation (DX) for customers in Japan and seeks to achieve a synthesis by bringing specialists from a variety of fields together at LIHT, including sales, engineer, designer, architect, and program manager from GlobalLogic and Hitachi.

GlobalLogic Japan's DX Team Structure and Processes

GL Japan is working on an organizational system that combines GlobalLogic's innovative knowledge and methodologies (GL-Way), with the business understanding and experience of the DX specialists at LIHT in working with customers in Japan. The way this works is called "two in the box," whereby DX specialists from GlobalLogic and LIHT are paired in core roles in both the pre-sales activity and delivery phases, respectively. The division of roles between them is worked out at the same time as investigating how to undertake the project in a way that suits the Japanese market. This involves GlobalLogic's specialists delivering services leveraging GL-Way while LIHT's DX specialists provide support by utilizing their understanding and experience with customers in Japan.

(1) Team structure and process for pre-sales activities

In response to expressions of interest from customers about GlobalLogic's worldwide experience and capabilities, the pre-sales activity phase involves introducing similar DX projects undertaken by GlobalLogic overseas and then drawing on Hitachi's past co-creation work with customers in Japan to put together a specific plan of action.

In addition to inquiries from customers interested in GlobalLogic, there are also cases where LIHT's DX specialists identify opportunities within their own customer base where GlobalLogic's capabilities can be useful in addressing the challenges those customers face. In these
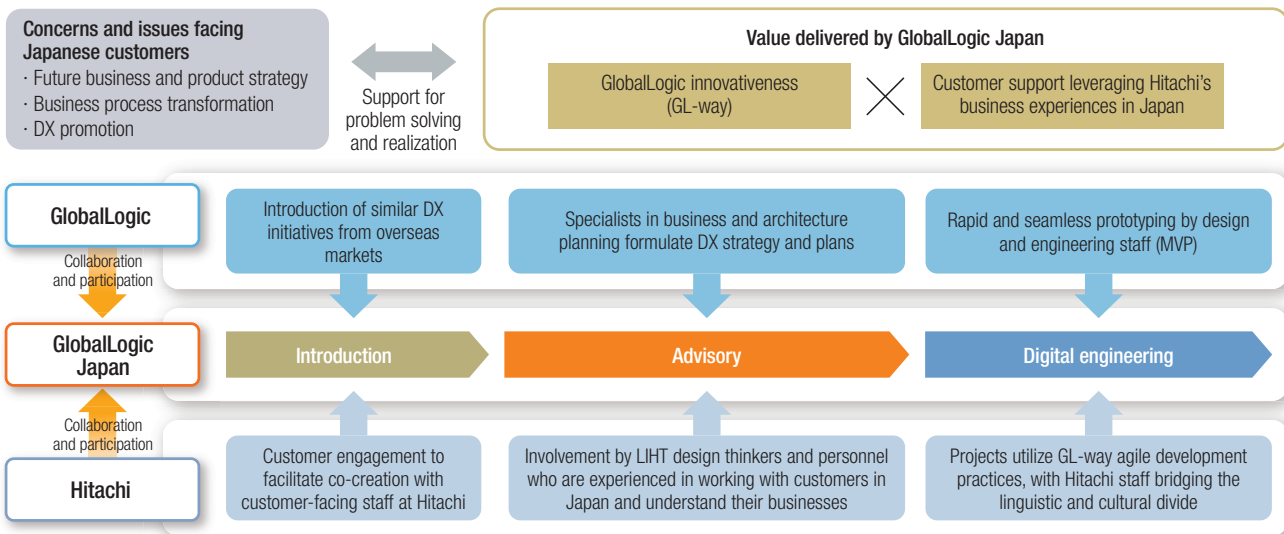
Figure 1 | **Specialists from GlobalLogic and Hitachi, Ltd. Engaging in Co-creation at LIHT**

Customers, partners, and a range of specialists from GlobalLogic and Hitachi combine the virtual and the real to support customer DX.

Figure 2 | **How Collaboration Works in Pre-sales Activity and Delivery Phases**

GlobalLogic is a leading company in the global DX business. To accelerate the digital business activities of customers in Japan, it applies its innovative knowledge and methodologies (GL-Way) to the Japanese market in tandem with customer support that draws on Hitachi's extensive business experience.

Concerns and issues facing Japanese customers · Future business and product strategy · Business process transformation · DX promotion	Support for problem solving and realization	Value delivered by GlobalLogic Japan		
		GlobalLogic innovativeness (GL-way)	×	Customer support leveraging Hitachi's business experiences in Japan

GlobalLogic	Introduction of similar DX initiatives from overseas markets	Specialists in business and architecture planning formulate DX strategy and plans	Rapid and seamless prototyping by design and engineering staff (MVP)
Collaboration and participation			
GlobalLogic Japan	Introduction	Advisory	Digital engineering
Collaboration and participation			
Hitachi	Customer engagement to facilitate co-creation with customer-facing staff at Hitachi	Involvement by LIHT design thinkers and personnel who are experienced in working with customers in Japan and understand their businesses	Projects utilize GL-way agile development practices, with Hitachi staff bridging the linguistic and cultural divide

DX: digital transformation   MVP: minimum viable product   LIHT: Lumada Innovation Hub Tokyo

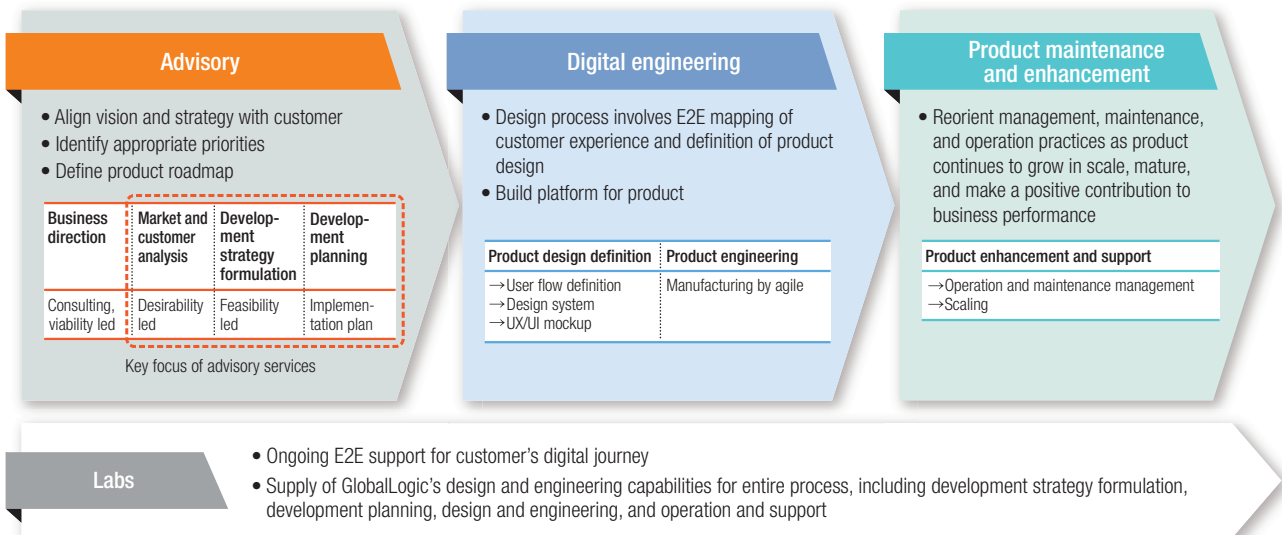cases, the DX specialists proactively introduce and propose GlobalLogic's services.

In this way, the two organizations are able to market themselves to customers in Japan in a way that draws on their respective strengths, combining GlobalLogic's extensive experience and success at undertaking DX around the world together with the DX specialists at LIHT who are conversant with the Japanese market and their customers' business context.

(2) Team structure and process for deliveries

For the delivery phase, the personnel required for the project are assembled from GlobalLogic's 39 engineering centers and nine design studios (as of November 2022) located around the world, taking note of the issues raised when consulting with customers during the pre-sales activity phase. The delivery phase itself involves combining GlobalLogic's distinctive agile processes for both design and digital engineering with DX specialists from LIHT who have experience in co-creation and other project work with customers in Japan.

Figure 3 | Service Offerings to Help Customers Accomplish their DX and Digital Journey

By partnering with customers engaged in DX, GL Japan provides service offerings that extend from the use of design thinking for market analysis and strategy formulation to development planning and the ultimate creation of a working product.

Advisory

- Align vision and strategy with customer
- Identify appropriate priorities
- Define product roadmap

Business direction	Market and customer analysis	Development strategy formulation	Development planning
Consulting, viability led	Desirability led	Feasibility led	Implementation plan

Key focus of advisory services

Digital engineering

- Design process involves E2E mapping of customer experience and definition of product design
- Build platform for product

Product design definition	Product engineering
→User flow definition →Design system →UX/UI mockup	Manufacturing by agile

Product maintenance and enhancement

- Reorient management, maintenance, and operation practices as product continues to grow in scale, mature, and make a positive contribution to business performance

Product enhancement and support
→Operation and maintenance management →Scaling

Labs

- Ongoing E2E support for customer's digital journey
- Supply of GlobalLogic's design and engineering capabilities for entire process, including development strategy formulation, development planning, design and engineering, and operation and support

GL Japan: GlobalLogic Japan   E2E: end-to-end   UX: user experience   UI: user interface

Pre-sales Activities and Service Offerings of GlobalLogic Japan

Taking note of the nature of the issues raised in pre-sales activities with customers, GL Japan brings together its experience and past work on design, engineering, and data science to provide end-to-end (E2E) support for the customer's digital journey, extending from experience-centric design and engineering that draws on the latest technologies to maintenance and enhancement.

In practice, this equates to two service offerings in particular: an advisory phase on identifying the DX services that end users are really looking for, and a digital engineering phase for implementing the cutting-edge technologies required for the proposed DX service. GL Japan can also provide engineering labs, enabling a flexible and agile response to market conditions and changes in customer strategies and tactics by providing comprehensive support across all steps in the digital journey, not just at specific phases such as the advisory and digital engineering phases. For example, support can be provided as an ongoing accompanied service whereby GlobalLogic staff with the required design and engineering skills work with the corporate customer on an in-house basis, serving as their DX research and development (R&D) team.

(1) Advisory

In the advisory phase, the "innovation sweet spot" is sought out in terms of desirability (user needs), business viability, and technical feasibility. This phase is undertaken by a team made up of four different roles (strategist, designer, architect, and program manager) that are filled by DX specialists from GlobalLogic and from the various divisions of Hitachi. The strategists seek to achieve an overall balance between the user needs, business viability, and technical feasibility of the customer's product or service, while the designers partner with the customer in investigations that seek to identify existing problems and DX opportunities from an experience viewpoint. The architects collate the technical issues and their impact on the business to determine an appropriate future architecture. Program managers manage the project to ensure that it proceeds in a way that is satisfactory for the customer, resolving project problems so that other team members are free to focus on their own respective roles.

Through interviews with end users and workshops with the customer, the people filling these four roles work together to determine what is needed and put together a roadmap for the product. They formulate a development plan on the basis of the agreed scope, which is determined in terms of the minimum viable product (MVP) that can deliver value at minimum cost.

(2) Digital engineering

The design-led digital engineering provided by GlobalLogic can be broadly divided into system-centric software and user-centric software. System-centric software specializes in chip-to-cloud system development involving the use of data that has been collected by edge devices and forwarded to the cloud. User-centric software, on the other hand, is about the touchpoint with users and includes end user applications and other products. GlobalLogic is also working to brush up its methodologies for fast and reliable service delivery utilizing global resourcing based on the Scaled Agile Framework*, and pursuing not only basic research into advanced technologies such as artificial intelligence and machine learning (AI/ML), Web 3.0, the metaverse, and non-fungible tokens (NFTs), but also work aimed at their practical application.

The digital engineering phase in turn involves bringing together the capabilities needed to resolve the challenges of DX and assembling cross-functional teams for the design and implementation of cloud-native software. The strategist and architect, meanwhile, having participated from the advisory phase, review the digital engineering to verify that the service being delivered satisfies the needs identified earlier in the project.
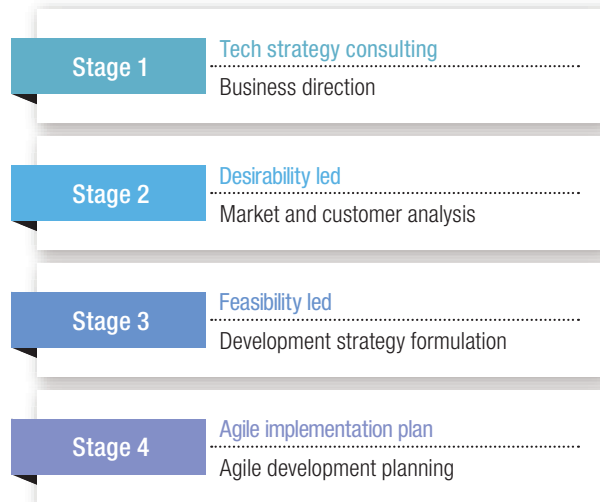
Case Study of GlobalLogic Japan's Approach to DX

One example in which GlobalLogic and Hitachi are bringing their different strengths to the provision of services to a customer in the Japanese market is a co-creation project with Nojima Corporation[(2)]. With the aim of improving the in-store user experience and having retail staff focus on consulting with individual customers about which products best fit their needs, Nojima is working with GL Japan to investigate how digital technology can be used in the retail environment. This includes a proof-of-concept (PoC) trial to test and verify these measures in an actual store.

* SAFe and Scaled Agile Framework are registered trademarks of Scaled Agile, Inc.

Figure 4 | GL Japan Advisory Stages

The advisory process can be broadly divided into four stages, starting with an exploration of business directions, followed by analyses of the market and target customers, the formulation of strategies for developing the best products or services, and detailed development planning. The process starts from the stage that best suits the customer's current circumstances.

Stage 1 — Tech strategy consulting — Business direction

Stage 2 — Desirability led — Market and customer analysis

Stage 3 — Feasibility led — Development strategy formulation

Stage 4 — Agile implementation plan — Agile development planning

The project follows the "two in the box" approach, with the strategists being design strategists from LIHT and METHOD, the strategic design arm of GlobalLogic. The designers are experience designers, also from LIHT and METHOD.

As the user experience when purchasing home appliances in Japan is very different than that in North America, the way that Nojima deals with customers was likewise unfamiliar to METHOD. Accordingly, they embarked on the joint work by having the Japanese team members use story-telling to demonstrate to their colleagues from METHOD the practices that Nojima values so highly for dealing with customers, drawing examples from their own user experiences of being served at a Nojima store.

Before starting on a DX project with a customer, GL Japan conducts workshops where they listen carefully to the customer's concerns and determine what it is that DX needs to achieve. In consultations with Nojima, they talked about three considerations in particular that they wanted DX to address. In the course of these discussions, GL Japan determined at what stage their advisory services should begin, deciding to start with a "Stage 2 Desirability Led" approach involving research and analysis, including in-store observations and interviews.

Figure 5 | In-store Survey and Idea Review Workshop

For the in-store survey, staff from METHOD and specialists from LIHT explore potential ideas for DX innovation by gaining a deeper understanding of the stores. Similarly, idea review workshops utilize rough drafts of the ideas being considered by GL Japan to discuss and prioritize them.

These in-store observations and interviews also used the "two in the box" approach. The project conducted observations at four Nojima stores and held interviews with 10 Nojima staff. In addition to providing language assistance to the METHOD designers, such as explaining the advertising stickers on products, the Japanese team members also helped speed up their learning by contributing knowledge about home appliance use in Japan and the features of the stores and their neighborhoods. The METHOD staff in turn drew on their unfamiliarity with Japanese practices to identify things that looked out of place and to provide essential insights.

Based on an analysis of these observations and interviews, they came up with 20 ideas for how the in-store user experience could be enhanced. A workshop was held a week after the completion of the study to present the results of analysis and discuss the improvement ideas. Two weeks after that, the ideas identified during the discussion as representing the highest priority concepts were presented to Hiroshi Nojima, Representative Executive Officer and President of Nojima Corporation. During this time, the architects worked with the strategists and designers to provide feedback on how feasible their ideas were from a technical standpoint.

This filtering of ideas through the consideration of user needs, business viability, and technical feasibility is a key feature of how GL Japan is able to focus in quickly on proposals that the customer will be able to implement. The result was a positive decision from Nojima management to proceed with a PoC trial. As of December 2022, this project is still running and trials of in-store digital initiatives are already underway.

The respective strengths of GlobalLogic and Hitachi encompass personnel, experience, and business footprint. What GL Japan has to offer is the ability to undertake projects by combining these in ways that fit with what is needed to resolve the challenges that customers face in the Japanese market. Such projects aimed at achieving DX are already underway for customers from a variety of industries in the Japanese market, including the finance area.

Future Plans

As the different parts of Hitachi come together to accelerate DX in the Japanese market and resolve societal challenges, the DX specialists from GlobalLogic and LIHT have been using project work to combine their resources under Lumada.

In the future, the intention is to use case studies and other means to spread knowledge across Hitachi, engaging in co-creation in ways that best suit customers and promoting DX in the Japanese market.

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Co-creation for Solving a Wide Range of Issues through Design and Digital

The Japanese government has proposed Society 5.0 as a concept for a human-centered society that balances economic growth with solutions to societal challenges through a highly integrated cyber-physical system. To realize this, technologies and approaches that are not an extension of conventional economic activities are indispensable. In addition to cooperation among industry, government, and academia, it is important to have a process of co-creation in which companies and organizations, which until now have conducted their businesses and activities independently, bring together their technologies and knowledge to solve societal challenges. With this as a background, Hitachi has been using design and data science to conduct co-creation with customers in various fields, as well as to develop methods for implementing the co-creation process and to train human resources. This section introduces Hitachi's co-creation approach, which utilizes design and digital technology to help solve issues faced by customers and society.
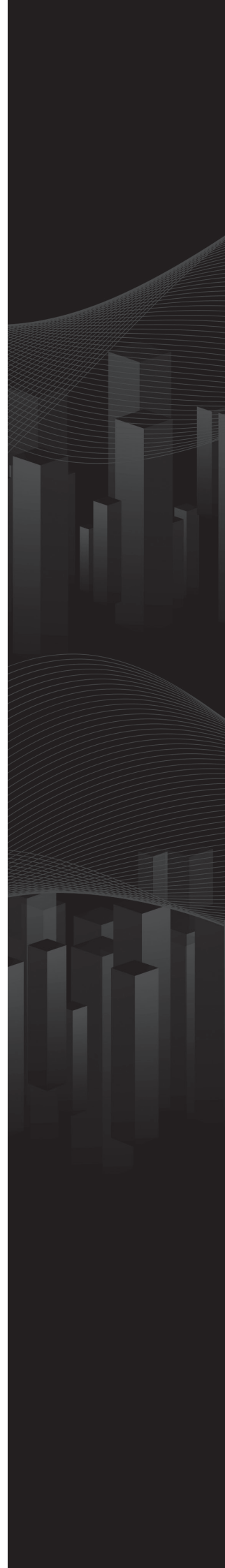
Hitachi's Co-creation Enhanced by Design and Digital Technology

Hitachi aims to realize Society 5.0 through co-creation in which solutions are designed and implemented in tandem with customers. Hitachi also has been using design and data science to respond to the issues facing customers in various fields, as well as to develop methods and to train human capital for expanding the number of collaborative creators. At the same time, companies are responding to complex societal challenges and drastic changes in the business environment while pursuing the next stage of growth, and the creation of value that is not an extension of conventional approaches has become a management issue. As the objective of customer co-creation expands from solving onsite business issues, such as improving business efficiency, to creating demand through new value, Hitachi's approach to co-creation is also evolving and building a proven track record of successful application. This article presents an overview of the evolution of co-creation approaches that utilize Hitachi's design and digital technologies.

Yoshimi Kasai
Masaaki Tanizaki

1. Introduction

Modern society faces a variety of challenges, including large-scale natural disasters, an aging society with a declining birthrate, and a deteriorating infrastructure. To solve these issues, Hitachi has been conducting collaborative creation (co-creation) with various stakeholders. The basis of co-creation is design thinking, which creates value through a quick trial-and-error process based on grasping the essence of the essential issues, and Hitachi has been working to expand the number of people involved throughout the company by converting the expertise developed by Hitachi's in-house design organization into methods.

On the other hand, as the complexity of issues increases and the speed of technological innovation grows, it is essential to evolve the problem-solving approach itself through co-creation. This article presents an overview of the evolution of Hitachi's approach to co-creation that uses its design capabilities and digital technologies.

2. Transition of Co-creation for a Better Society

2. 1
Creation of Innovation through Co-creation

The Japanese government has clearly defined the concept of Society 5.0[1] as a vision of a society that aims at both solving societal challenges and achieving economic growth. This is supported by a system that highly integrates cyberspace and physical space, and Hitachi aims to realize this through the creation of Social Innovation Business. In order to create innovations and implement them in society, it is essential to examine them from a wide range of perspectives, including the experience value they provide to people, technological feasibility, and business potential. In this context, Hitachi has been conducting co-creation with customers and partners to identify onsite issues and to create new services that contribute to solving them.

Underpinning the co-creation work are the mindset and skills of design thinking, such as the approach of grasping

Figure 1 — Co-creation Activities at Lumada Innovation Hub Tokyo

Specialists in various fields, such as design, data science, and engineering support co-creation activities. Lumada Innovation Hub Tokyo is equipped with space and facilities suitable for these activities, and is conducting exchange meetings to share advanced case studies, idea generation through workshops, and rapid value verification through prototyping.

essential issues by gaining insight into the context and pursuing the experience value for service recipients through repeated trial and error. In addition to developing NEXPERIENCE[2], a methodology for performing co-creation, Hitachi has also been expanding the human resources it has who are capable of performing co-creation within the company by running an educational program and certification system for design thinking. There are a steadily growing number of cases where not only design specialists, but also those in charge of business planning, sales, and system development are gaining the mindset and skills to lead the creation of innovation.

Also, Society 5.0 is a society that creates a cycle in which a digital twin is constructed in cyberspace using a wide variety of data, physical space is changed by actively utilizing artificial intelligence (AI), and the results are reproduced in cyberspace. Hitachi established the Lumada Data Science Lab.[3] in 2020 to tap into the latest trends in the rapidly changing field of AI and data analytics, enhance the skills of its researchers and engineers, and apply technology and expertise to society and business settings.

2. 2
Responding to Increasingly Complex Societal Challenges

Hitachi has built up a proven track record of improving the efficiency of customer operations through co-creation, for example, by improving productivity at manufacturing sites and reforming work styles in offices. Also, in recent years, Hitachi has received growing numbers of consultations on more complex societal challenges, such as carbon neutrality, infrastructure upgrading, and measures to address population decline. These societal challenges involve people in a wide range of positions, such as companies, governments, and consumers, and it is difficult for a single organization to solve them alone. It is essential to narrow down the issues to be solved while involving a wide range of stakeholders, gather knowledge and ideas, and build consensus on measures while confirming their effectiveness. Hitachi established the Lumada Alliance Program in 2020 as a mechanism to address issues together with various partners.

In April 2021, the company established Lumada Innovation Hub Tokyo (LIHT)[4] as a co-creation place for companies, governments, consumers, and others in various capacities to gather and combine their knowledge and ideas (see **Figure 1**). LIHT holds events to discuss and disseminate visions for the future society, and conducts workshops and idea validation to generate concrete service ideas. In only its second year of operation, approximately 10,000 people use this place annually to implement co-creation to solve social and customer issues with people from a wide range of perspectives, including corporate executives, onsite personnel, government agencies, consumers, and academia.

2. 3
Addressing Management Issues for Business Transformation

As societal challenges of high complexity have become high on the agenda, there have been increasing opportunities for corporate executives to participate in co-creation projects. The discussions include how to respond to the dizzying changes in the external environment, what kind of value can be provided to the coming society, and how to evolve toward the desired future. Here, a balanced approach that combines "backcasting from our desired future" and "designing realistic next steps based on where we are now" is necessary (see **Figure 2**).

For the former, backcasting provides insight into what people's values and lives will be like in the future and what kind of experience value people are looking for. Hitachi has developed a methodology called "*Kizashi*" (signs) for identifying future trends and applied it to co-creation. Through a series of co-creation projects for local revitalization and workshops with junior and senior high school students, Hitachi is accumulating and disseminating real opinions about changes in values and lifestyles. The study must be conducted from the standpoints of experience value, feasibility, and business potential. In addition to vision designers and service designers with skilled insight into experience value, technologists and business designers will also participate in the study.
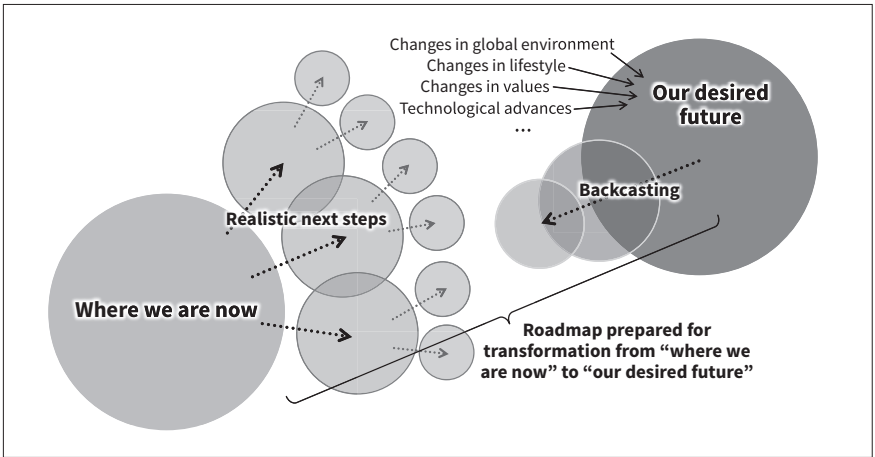
Figure 2 — Preparing a Roadmap to Business Transformation

Corporate managers must be ready for medium- to long-term social changes while responding to a growing number of daily changes. A roadmap must be prepared while maintaining a balance between "designing realistic next steps based on where we are now" and "backcasting from our desired future."

For the latter, the design of feasible steps requires experts in digital engineering who are skilled in materialization and have the ability to design growth scenarios for shaping what the desired future will look like. In digital engineering, GlobalLogic's activities are covered in this issue's Cover Story "Activities 3: Driving Digital Transformation in Japanese Market through Co-creation by DX Specialists" (page 25). Hitachi engineers, including GlobalLogic engineers, are participating in the study of what kind of technology will be used to realize the desired future. In addition to technical feasibility, it is also important to consider the value provided and the business potential, and based on these perspectives, Hitachi is working together with management to create growth scenarios and develop methods.

3. Evolution of the Co-creation Approach Discussed in This Issue

The previous section described the issues that Hitachi addresses in its co-creation projects and the evolution of its approach (see **Figure 3**). This section introduces the co-creation processes and methodologies that address management issues for business transformation, with a focus on the topics raised in this issue of *Hitachi Review*.

3.1
Design of Business Growth Scenarios for Shaping the Desired Future

Companies are expected to take actions to realize sustainability while also ensuring business growth. Hitachi has used NEXPERIENCE, a co-creation methodology, for several hundred projects and has built up a track record of solution development centered on improving customers' operational efficiency. On the other hand, in order to meet the points in the agenda required by society as a whole, such as sustainability, a company must have the technology to shape the desired future and the technology to draw the path to reach that future while growing the business.

To this end, Hitachi developed a method to prepare business growth scenarios to realize not only improved business efficiency, but also business growth by creating new demand while also realizing the future that society demands. Societal challenges are becoming increasingly complex, and partnering with a variety of companies is essential to shape the desired future. The developed method is a step-by-step process that defines how partnering among multiple companies can achieve both economic value and social value. For details, see the articles "Engagement with Customers on Business Growth Scenarios that Anticipate Future Value"

Figure 3 — Co-creation Approach for Expanding Issues

The approach is based on considering measures while taking into account the balance between experience value, feasibility, and business potential, starting from the essential issues and the value provided, while evolving the method of co-creation as the issues to be addressed expand.
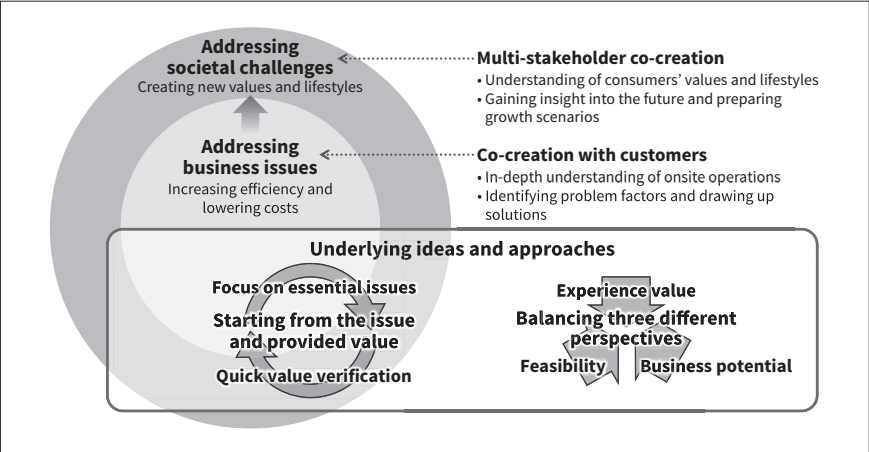
(page 36) and "New Methodology and Applied Example for Identification of Issues to Enable Action on Societal Challenges" (page 45) in this issue.

3. 2
Extracting Changes in Values and Lifestyles

The COVID-19 pandemic, which began in 2020 and spread globally, quickly accelerated a number of social changes. The rapidly growing recognition of the Sustainable Development Goals (SDGs) has also brought about changes in what corporate stakeholders, such as shareholders, employees, and consumers, consider important. As a result, companies are faced with new management issues that cannot be dealt with simply as an extension of their conventional business operations.

Previously, Hitachi conducted ethnography to extract the actual business conditions, issues, and latent needs of its customers. Applying ethnography, which has proven itself in a wide range of business domains, Hitachi has recently broadened its perspective to include a wider range of stakeholders involved with its customers and is attempting to capture changes in values and lifestyles. Hitachi also experienced a period when onsite observation research was difficult due to the COVID-19 pandemic, leading it to develop a remote research method. The article "Creation of Digital Services through Consumer Understanding" (page 41) in this issue describes the methodology and presents an example of its application in the railway sector.

3. 3
Use of Digital Technology in Co-creation

Data science, which is based on data-driven scientific methodologies and processes and utilizes AI and statistics to create business value and implement it in society, is becoming increasingly important. For example, Hitachi has experience in planning optimization to continuously maintain and improve productivity and profitability, and in materials informatics (MI), which transforms the process itself by utilizing digital technology in the development of new materials. Hitachi has also developed a framework for quickly identifying problems to be solved in the field of data science and for smoothly connecting insights gained from data analysis to system implementation[5]. This framework has been applied to a wide range of fields, including infrastructure-related businesses, manufacturing, and transportation, and has had the effect of increasing the speed of provided value.

Co-creation projects utilizing blockchain are also being implemented. In the proof-of-concept project in a local community, Hitachi verified with users the image of a future society in which residents and local businesses are loosely connected and cooperate with each other in a world where the local government is becoming vulnerable due to the declining birthrate, aging society, and shrinking population.

Furthermore, the use of the metaverse in co-creation is also increasing. In areas where the metaverse is applied to industry,

there are efforts to implement planning and study of onsite work in a virtual space. When conducting discussions that combine diverse wisdom and ideas, it is also important to foster an atmosphere in which participants can exchange opinions equally from the same standpoint. Moreover, efforts are underway to build the collaborative space itself into a metaverse.

4. Conclusions

This article has presented an overview of the evolution of Hitachi's co-creation approach which uses design and digital technologies to shape the desired future. While following the basic concept and process of co-creation starting from the issues and the values provided, Hitachi's approach has evolved with the expansion of the issues to be addressed.

Hitachi will continue to work with a variety of stakeholders, including consumers, government agencies, and businesses, to achieve economic growth and solve societal challenges by applying co-creation in more and more cases. Hitachi is also updating its co-creation methodologies and knowledge, and will globally deploy the solutions created in Japan, a developed country facing its own unique set of challenges.

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Engagement with Customers on Business Growth Scenarios that Anticipate Future Value

With today's rapidly-changing social environment, it is said that the "synchronization" between social sustainability and corporate sustainability is essential. This synchronization can be viewed as a transition of society and the company to a desired future in which the company's business operations contribute to the sustainability of society as well as its own growth. Hitachi has applied NEXPERIENCE, a co-creation methodology, to several hundred projects to date and has achieved results, but from this point forward, co-creation with various partners will be essential to shape the desired future. This is what led Hitachi to develop a method for designing business growth scenarios, which depict the steps of operations that generate economic value for companies and create a sustainable society, and utilize it with its customers in the logistics sector. This article describes Hitachi's efforts to contribute to the realization of sustainable and harmonious business growth together with its customers through co-creation.

Eitaro Ito
Haruko Nagaoka
Zhenhua Cai
Yukihiro Kizawa

1. Introduction

With the rapid changes in the social environment, society as a whole is undergoing a major shift toward a focus on sustainability (social sustainability in terms of climate change and respect for human rights, as well as the long-term providing of value and sustainable growth in earning power by companies). The ITO Review 3.0 issued by the Ministry of Economy, Trade and Industry (METI) in August 2022 states that companies that do not address sustainability-related issues are finding it increasingly difficult to gain recognition from investors, consumers, and the labor market, and as a result, their continued business operations are being adversely affected in many cases. On the other hand, it stated that this change offers an opportunity to further accelerate X (transformation), as companies are required to

boldly pursue discontinuous changes that are not an extension of their conventional operations. The report also states that in order to implement sustainability transformation (SX) and green transformation (GX) effectively and quickly, they also should be integrated with the implementation of digital transformation (DX)[1].

In other words, companies are required to envision their desired future from a long-term perspective with regard to sustainability, and work towards it in a step-by-step manner for business growth through DX[2],[3]. Specifically, it will be essential for companies to achieve sustainability by combining operational efficiency and demand creation in their business operations, and it will be even more important to develop and realize a long-term vision and growth roadmap for their business based on this vision.

Hitachi has been providing co-creation system integration (SI) services that identify onsite issues and develop solutions through collaborative creation (co-creation) with

customers, and has accumulated the knowledge gained through these services in Lumada[4]. This led Hitachi to design and implement a business growth scenario design methodology that creates a roadmap scenario for realizing not only economic value, but also social value, in an effort to achieve the sustainability required in the future.

This article introduces Hitachi's co-creation efforts in the logistics sector using a business growth scenario that balances sustainability with harmonious business growth.

2. Latest Trends of DX for Realizing Social Value

As mentioned earlier, companies are being called upon to balance economic value and social value. However, economic value and social value can sometimes conflict, as when operations that seek to expand business performance increase the environmental burden. In order to achieve both of these goals, it is essential to incorporate business growth scenarios into daily business operations in a concrete manner, and at the same time, to visualize the actual status of operations to ascertain whether they achieve management goals, and to conduct DX to improve productivity. However, the reality is that many companies, while understanding the necessity, are still trying to find the best place to start[5]. Because of this situation, services to support DX began to appear several years ago.

Siemens AG offers a roadmap development service that takes into account a company's DX maturity level. In this service, the consultant grasps and evaluates the DX maturity level onsite through workshops with customer company stakeholders, determines the overall direction, and supports the implementation of DX by preparing a roadmap that matches the customer's situation.

Since 2007, Accenture PLC has been aggregating the knowledge of more than 40 industries held by its global offices, and by creating templates of this knowledge, the company has been able to provide its customers with quick and accurate solutions. Accenture also offers AI Powered Knowledge Sharing, a service that supports data-driven business operations by drawing value from customers' own data as they enter 2022. In this system, artificial intelligence (AI) analyzes the context of issues faced on site and presents appropriate solutions in real time from data held both inside and outside the company.

The government has also targeted DX in industry as a key measure. METI has defined DX indices and guidance to raise awareness of DX among companies and managers, and is attempting to accelerate the process by taking measures such as company certification and the selection of excellent companies according to their level of DX[6].

These trends suggest that the demand for services that enhance corporate strength through DX will continue to increase.

3. Developing Business Growth Scenarios with Customers with a Long-term Vision

The previous section described services for increasing corporate value through DX support. Still, in the last several years, companies have found themselves in a business environment that they have never experienced before, with the COVID-19 pandemic, soaring oil prices, drastic exchange rate fluctuations, global warming, and a shrinking work force making the future outlook unclear. Under these circumstances, it will be a challenge for companies to set up a long-term vision to create not only economic value, but also sustainable social value, and to find a way to create a business roadmap to realize this vision.

3.1
Methodology for Designing Business Growth Scenarios from the Customer's Perspective
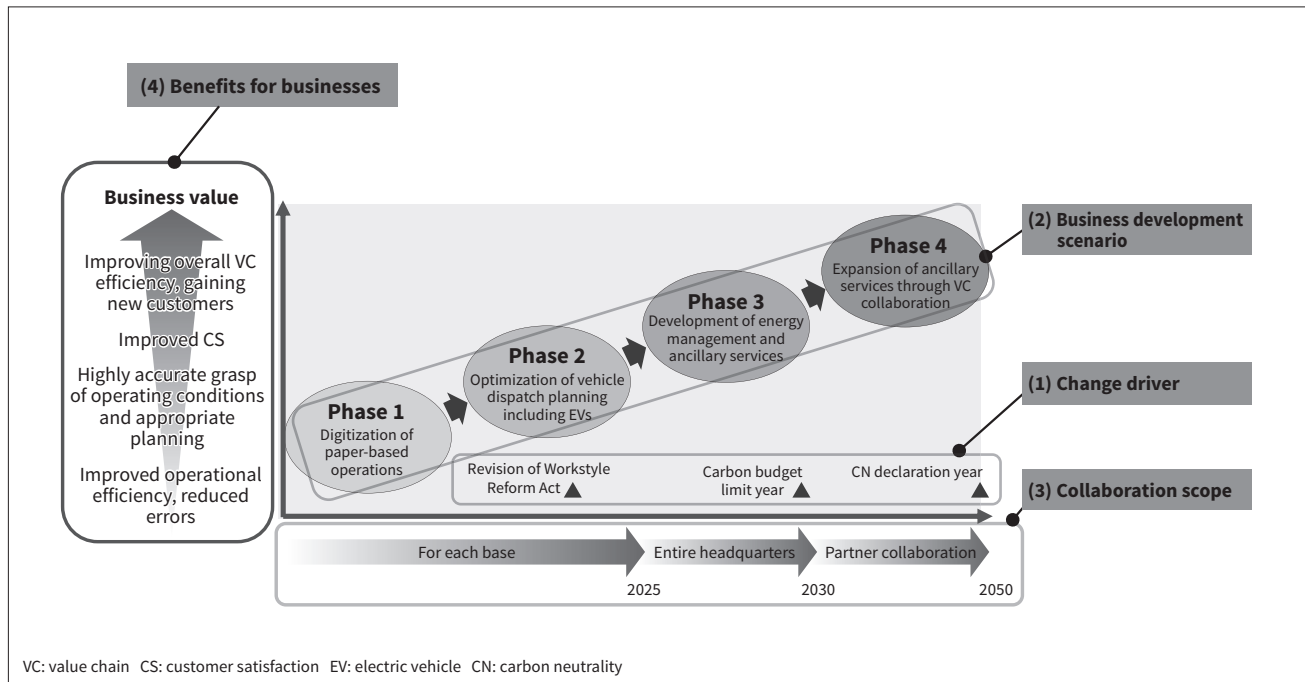
The business impact of changes in the business environment varies by industry and company. For example, some industries were hit hard by the COVID-19 pandemic, while others benefited. This led Hitachi to develop a business growth scenario design methodology that takes into account changes in the business environment from the customer's perspective and defines how the business will respond and change through DX toward the desired future corporate vision laid out by the customer's management (see **Figure 1**).

The business growth scenarios consist of four main elements: (1) change drivers such as events and megatrends that are expected to have a large impact on business, (2) business development scenarios that take into account the business impact by the change drivers and gradually reform and change business and operations toward the desired future corporate vision, (3) the timing for implementing the scenarios and the scope of collaboration among the stakeholders who should collaborate in each phase to implement the scenarios, and (4) the realized value for the businesses that the scenarios will bring in each phase. The change drivers here refer to future matters for which enforcement is predetermined, such as revisions of laws and regulations, and to uncertain matters, such as changes in the business's customers. The latter include, for example, demographic changes affecting demand, consumption trends, capital and IT investment trends, and behavioral changes such as ethical consumption in line with growing interest in the Sustainable Development Goals (SDGs).

The purpose of developing business growth scenarios is to create a preparatory step (roadmap) for realizing the sustainability that customers demand through empathy, rather than just making DX initiatives more efficient in certain operations. Hitachi will continuously design and provide the combination of solutions needed to move to the next

Figure 1 — Business Growth Scenario and Its Main Components

The figure shows the methodology for designing the steps of improvement and reform based on the current situation toward the desired state that a company aims to achieve through DX.

VC: value chain   CS: customer satisfaction   EV: electric vehicle   CN: carbon neutrality

phase by following this scenario, and flexibly change the scenario as needed if the business environment changes from initial expectations.

3. 2
Implementation in the Logistics Sector

The logistics sector is an industry where many change drivers lie ahead. First, in 2024, the so-called "2024 issue" is expected to require drivers to reduce their working hours due to the impact of the amended Labor Standards Act, and by 2030, it is said that the number of drivers in the road freight transportation industry is expected to decrease to about 53.3% of the 2000 level[7]. Furthermore, measures to achieve carbon neutrality are also essential.

In this instance, the customer that Hitachi collaborated with is a medium-sized company that provides services to corporations with offices nationwide. In addition to measures to address the above-mentioned issues, management identified the improvement of service quality and value-added services as essential initiatives for the company as a whole. On the other hand, when Hitachi surveyed the onsite issues faced by each sales office, they voiced a variety of frank opinions. In addition to handling various types of transaction slips at workplaces with many suppliers, there are still many analog processes. As a result, it took time to collect and organize the information necessary for vehicle dispatch planning, and when sudden changes occurred, it was time-consuming to review the plans, and errors were common. Also, a handheld terminal was adopted to improve inspection efficiency, but with the aging of workers,

there were some who said that the additional items were too heavy to carry. The site manager saw the gap between these survey results and the future envisioned by management and thought that some measures were necessary, but was having a hard time designing measures to get started.

3. 3
First Steps by Developing Business Growth Scenarios

Hitachi first structured the customer issues using a Business Issue Organization Tree in order to get a structural view of the customer issues and to identify the priority issue areas to be addressed. This is always created before starting a business growth scenario. The value chain is integrated horizontally, where the management's vision of the future company and recognition of issues are placed vertically at the top, and the relationship between the issues and impediments for the onsite staff to realize the management's recognition of issues are structured vertically in a tree shape at the bottom (see **Figure 2**). Onsite issues are broken down into the business processes that make up the value chain, and sometimes unexpected common points can be found among different business processes. With this in mind, scoring was conducted from the viewpoints of the multiple parties involved, including the onsite managers and those in charge of the site, to identify areas of high priority for taking action.

Based on the DX status (extent of digitization and digitalization) of the identified areas, Hitachi prepared a scenario consisting of several phases, including the measures that should be started first and what actions should be

Figure 2 — Structure of Business Issue Organization Tree

The relationship between the business issues faced in realizing the management goals of a company and the process up to reaching the proposed measures is structured in a tree-like form to enable a bird's-eye view of the entire process.

RFID: radio frequency identification   OCR: optical character recognition
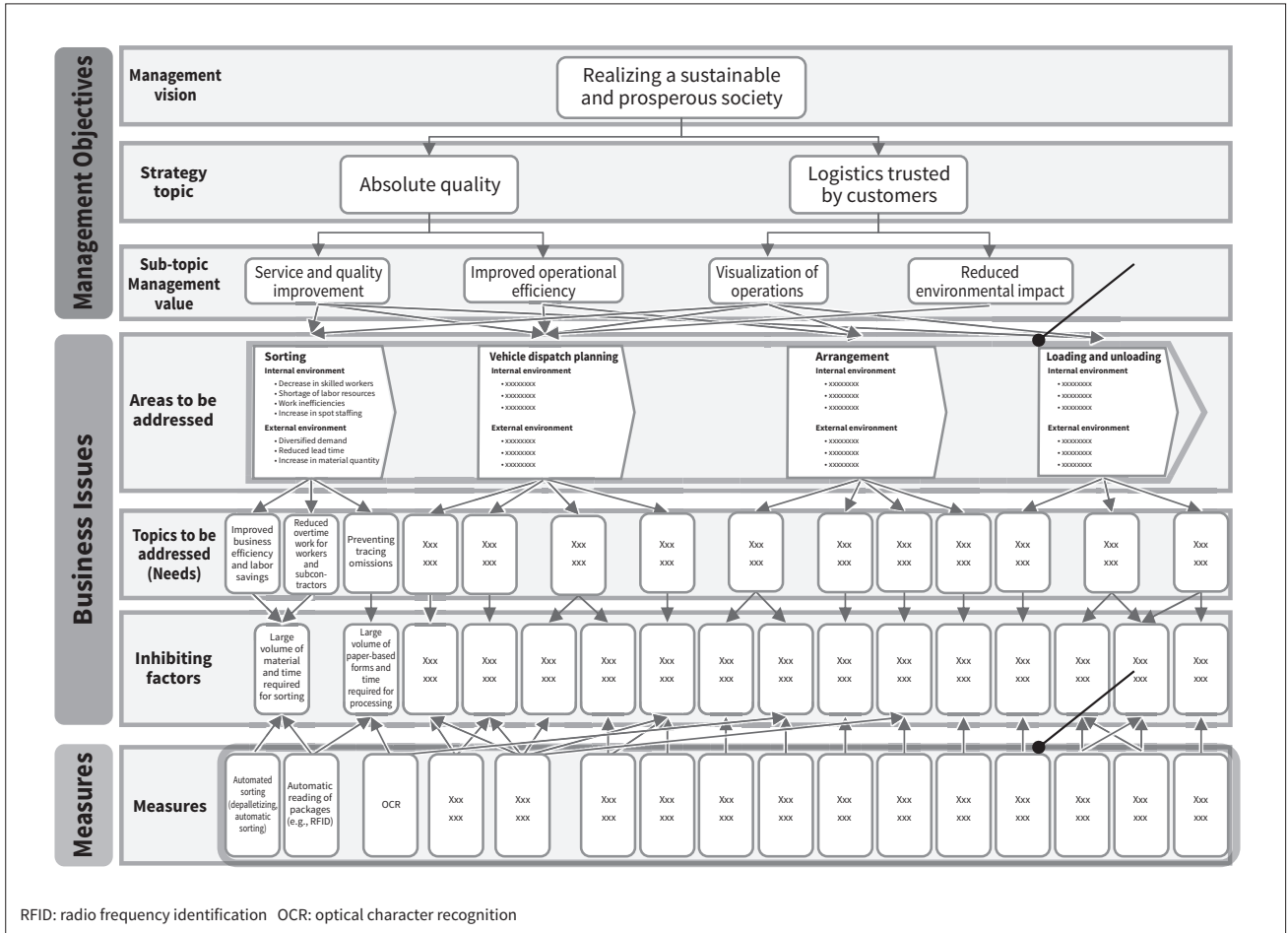
implemented by a certain time in response to the change drivers described above. The initial phase is the early digitization of data related to the series of operations associated with vehicle dispatch planning, which has become a bottleneck. The next phase is the reduction of CO_2 emissions by streamlining vehicle dispatch planning and thereby optimizing the number of trucks in operation. This phase is followed by the creation of value-added services by allocating the time margin gained from the streamlined operations to other operations. In addition, the number of sites and stakeholders targeted in each phase is expanded in stages. According to the customer, the digitization of data had been considered several times in the past, but had been put off because it could not be shown to be cost-effective. In this case, however, the customer was able to identify the scope of work to be undertaken in the initial phase and present a solution that fit the budget. Then, the customer was able to demonstrate that this initiative was not a partial improvement in operational efficiency, but part of operations aimed at achieving sustainability, enabling the customer to obtain management approval to begin the improvements. Currently, the initial phase of solution implementation is underway.

Business growth scenarios cannot be prepared unless Hitachi understands the way of thinking of the customer's management and the operations at the onsite level, and has broad foresight into how the customer's business environment will change and how it will be affected. Hitachi believes that further enhancement of these skills will be essential in the future.

4. Conclusions

Thus, by using a business growth scenario consisting of several growth phases in the logistics sector, Hitachi was able to achieve a long-term vision for sustainability and the creation of a business roadmap to realize the vision.

Looking forward, companies that pursue only their own efficiency without considering their contribution to sustainability will have difficulty gaining recognition from investors, consumers, and the labor market, and it is expected that companies will accelerate their sustainability efforts.

Hitachi will continue to contribute to society and corporate transitions for realizing sustainability through co-creation using business growth scenarios.

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Creation of Digital Services through Consumer Understanding

The COVID-19 pandemic, which began in 2020, created a crisis of a type never seen before and accelerated changes to society and people. People's values and beliefs have changed, and companies are now faced with management issues that are difficult to resolve with the old ways of doing business. Hitachi believes that focusing on and developing a more in-depth understanding of stakeholders surrounding companies and the consumers beyond them will lead to the creation of better business solutions in the future. This article describes the studies Hitachi has conducted on understanding consumer values and digital services by using the railway business as an example.

Yuuki Hara
Tomoyuki Mochizuki

1. Introduction

Modern society is at a major turning point. The business environment has changed dramatically over the past few years, as companies are increasingly required to address environmental issues. Also, the COVID-19 pandemic, which began in 2020 and spread globally, quickly accelerated changes in society. The restrictions on the exchange of people, flow of goods, and economic activities that accompanied the lockdowns caused a global economic downturn that dealt a severe blow even to companies that had maintained high performance[1]. Global unemployment and declining incomes not seen since the Great Depression have created uncertainty about COVID-19 with no end in sight, and have reduced consumption and investment in daily life and changed the way people live their lives. Even so, daily mobility had to be restricted and real contact with people and things decreased, prompting greater use of digital services by consumers, including the elderly, who had typically kept their distance from IT[2]. Thus, COVID-19 created a new type of crisis that was different from the Great East Japan Earthquake and the global financial crisis.

Furthermore, with the expansion of stay-at-home consumption and the use of digital services among consumers in the COVID-19 pandemic, companies are transforming themselves in response to the new normal by using digital technology to form new points of contact with consumers.

Under these circumstances, companies are faced with management issues that cannot be dealt with simply as an extension of their conventional business operations. Hitachi believes that, from now on, it will be possible to create solutions that support the resolution of management issues not only by focusing on the business and operations of companies themselves, but also by gaining a better understanding of the stakeholders and end-users who are the consumers that influence business operations. This article describes the studies Hitachi has conducted on understanding consumer values and digital services by using the railway business as an example.

2. Understanding Consumers' Interactions with Railway-related Digital Services

Hitachi has been conducting ethnographic research of customer operations to extract real business conditions, issues, and latent needs based on onsite observations, and has been deriving solutions that bring value to customer management and business. The company has conducted about 200 ethnographic research projects in Japan and abroad at operations sites in a wide variety of domains, including electric power plants, finance, medical care, chemical plants, and

construction machinery maintenance work. In the railway system, ethnographic research has been conducted in operation command, train maintenance, and station attendant work[3],[4]. Recently, however, the way of doing business has been changing along with social changes. This is what led Hitachi to consider whether it could create services that contribute to the management and business of its customers by focusing on and understanding not only their businesses, but also their consumers.

With the spread of COVID-19, more and more people are trying to avoid using public transportation. People who use crowded trains and buses for work or errands have expressed strong concerns about infection. Public transportation operators were asked to take measures so that people could move around with as much peace of mind as possible. With measures to alleviate congestion becoming a priority for railway operators, Hitachi embarked on a preliminary study to understand the ways in which consumers move around using public transportation. Specifically, a qualitative study was conducted in a regional core city with the aim of understanding the actual way that people move around in the era of COVID-19 and the values behind it. Although Hitachi has previously conducted field research of passengers served by station attendants using Hitachi's solutions, this time Hitachi attempted to understand them by expanding the scope to include consumers living along the railway operators' lines.

Specifically, the ethnographers first visited the site and actually walked around to understand the geography and transportation characteristics. Next, they conducted remote in-depth interviews with consumers living along the railway and bus lines in the area. The interviews aimed to clarify how consumers move around on a daily basis and how they have changed as a result of the COVID-19 pandemic. The interviews also explored how these consumers moved around and the ideas and values that are connected to these changes. As a result, Hitachi hypothesized that there are three types of ways in which consumers living along the railway and bus lines move around, mainly in regional cities: (1) flexible use of new and different means of transportation, (2) establishment and adherence to their own means of transportation and patterns, and (3) dependence on specific means of transportation under environmental restrictions. It was thought that behind the way consumers move around are not only geographical and economic constraints, but also distinctive differences in values and decision-making logic related to the way they move around. For example, people who choose their transportation according to type (1) have a strong orientation toward actively exploring what interests them in their daily lives, and among various transportation mode options, they actively choose the way of moving around that suits their interests at the time, such as "The weather is very nice today, so I'll enjoy the weather while riding a shared bicycle on the way there instead of taking the train," or "It's crowded due to the COVID-19 pandemic, and so instead of getting on the train at my usual station, I'll walk to a station along the route while exploring new stores." In this way, these people place value on enriching their daily lives. On the other hand, people who choose their transportation according to type (2) have a strong orientation toward planning for efficiency and cost-effectiveness in their daily lives, and when choosing a means of transportation, they place value on moving around in a way that does not disrupt their pre-made plans because of its importance to them, such as "I would like to avoid taking a bus if possible because delays are hard to predict, and even if the train is crowded due to rain, I'll just bear the inconvenience for a short time because I know that I can travel on an exact schedule with the train." Thus, the differences in the way consumers living along the railway and bus lines move around due to the COVID-19 pandemic are thought to be tied to their respective values and orientations. The true direction of digital services that are effective in both moving around and reducing congestion due to the COVID-19 pandemic become clear only when researchers understand the perspectives from which consumers hold expectations and attach meaning to the transportation network and surrounding places provided by public transportation operators.

3. Digital Services to Support Safe and Comfortable Travel during the COVID-19 Pandemic

In the new normal era, when the COVID-19-induced behavioral changes took place, people became more selective about their mobility. The rapid spread of remote work and online classes reduced the number of work and school commuters, and inbound demand also decreased due to the one-time restrictions on entry from foreign countries, resulting in about 70–80% fewer public transportation users than before the spread of COVID-19. The drop in the number of users was also accompanied by a corresponding decrease in the use of commercial facilities at stations and along railway lines. The future with lower public transportation ridership, which was thought to be 10 to 15 years away, has suddenly become a reality. With this as a background, Hitachi and Nishi-Nippon Railroad Co., Ltd. have been studying ways to revitalize transportation and the city's economy while ensuring that people can move around safely and comfortably (see **Figure 1**). Since many users are particularly concerned about congestion due to the COVID-19 pandemic, Hitachi and Nishi-Nippon Railroad examined how to level congestion and promote mobility during non-peak hours. This was done by focusing on "nudges" as a means to achieve this.

To "nudge" means to prod someone lightly with an elbow and is used to refer to methods or practices that, rather

Figure 1 — Aiming for People's Safe and Comfortable Travel and Urban Revitalization

The total volume of travel is increased by decentralizing travel demand to level congestion and by creating stress-free travel destinations.
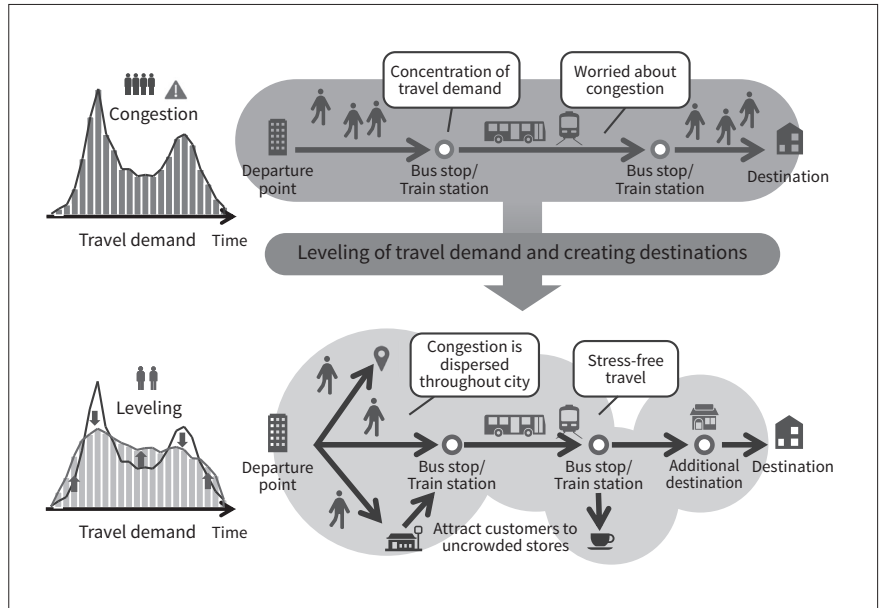
than forcing people, encourage them to act in a certain way at their own volition. However, a single nudge may have little effect on behavior change. Accordingly, Hitachi has developed nudge-linking technology to link a series of related nudges and nudge personalization technology to change the content of nudges according to the type of user, with the aim of expanding the effectiveness of nudges. Then, Hitachi developed a prototype web app that can be used with smartphones that utilizes this nudge-applied technology and conducted the Demonstration Project for Safe and Comfortable Transportation in Fukuoka in 2021 and 2022 (see **Figure 2**).

When performing a route search on the web app, it presents the congestion status of the means of travel, suggests alternative routes that are less congested, and encourages travel at times that avoid congestion by changing departure

times or stopping at commercial facilities. The user selects a travel route that matches his or her preferences by looking at the information presented. This will naturally encourage users who are concerned about congestion to take action to avoid congestion, resulting in a leveling of overall congestion.

In order to maximize effectiveness, it is necessary to understand the characteristics of the city and the characteristics and values of its people, and to provide recommendations that match the preferences of the users. Therefore, it was decided to classify the types of consumers living along the railway lines by analyzing them, determine which type they are through a questionnaire when they start using the web app, and switch the content of the proposals to match the preferences of the users.

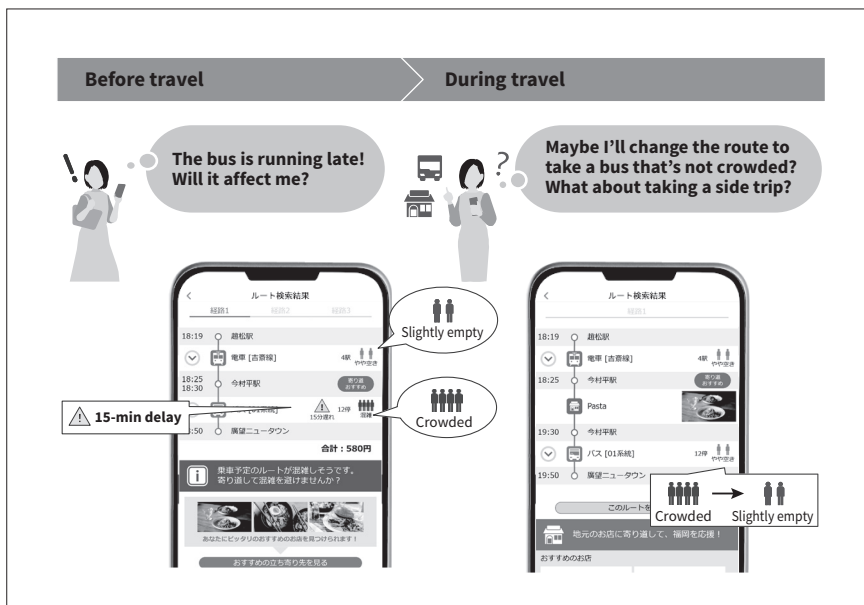The demonstration project confirmed the effects of reducing congestion during peak hours and stimulating

Figure 2 — Services Provided by Demonstration Project for Safe and Comfortable Transportation

By checking congestion and operation conditions before traveling and choosing to change routes or take side trips, people can naturally avoid congestion while moving around.

demand by prompting users to visit and stop by commercial facilities. This is expected to contribute to the revitalization of transportation and commercial services while providing safe and comfortable transportation.

4. Conclusions

As people's working styles and lifestyles continue to change in the wake of COVID-19 and other events, there is also a shift from a concentration of people in large cities to a decentralization of people in rural areas. Companies are expected to move toward a future in which they will be more oriented toward coexistence with local communities and will walk together with the local people. Hitachi will also contribute to the wellbeing of people and the realization of a society that does not exceed the planetary boundaries, by providing digital services that support a sustainable future for customers and communities.

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New Methodology and Applied Example for Identification of Issues to Enable Action on Societal Challenges

With the emergence of societal challenges including global warming and the attention they have drawn, solving these societal challenges has become one of the main objectives for companies along with the pursuit of profits. In addition to focusing on issues such as productivity and efficiency improvement, it has become necessary to address societal challenges with a new business development methodology. This article describes the process of developing businesses that address societal challenges and creating new demand by utilizing near-future social change scenarios called "greenfield opportunities." As an example of its application, this article will present a project implemented in fiscal 2021 at Asset Management One Co., Ltd.

Ippei Numata
Maiko Kaneda
Shoichi Kanzaki
Kaoru Kato

1. Introduction

The era in which companies only need to pursue their own profits is about to become a thing of the past. With the emergence of various societal challenges such as global warming and an aging society with a declining birthrate, companies are being strongly urged to fulfill their responsibilities as members of society. Responding to social responsibility has become one of the main objectives of corporate initiatives, along with the pursuit of profit.

Under these circumstances, in the business development process, it is becoming increasingly important to consider macro trends, such as societal challenges, and to respond to newly emerging demands and issues, or to stimulate new demands, rather than focusing only on the current onsite issues that the business is facing. This article describes a new business development process that focuses on future societal challenges.

2. Issues with Past Business Development Processes

In the past, business development processes have mainly taken a business problem-driven approach, in which the issues faced by the current business are identified using onsite survey methods such as ethnography, followed by improvement initiatives that repeat the plan, do, check, act (PDCA) cycle or that attempt creative problem solving in the design thinking style. Such an approach had the advantage of targeting individual and specific issues in the field, making it easier to forecast concrete results, such as improved productivity and efficiency. On the other hand, this approach makes it difficult to formulate future-oriented questions including demand creation and problem solving with a medium- to long-term future in mind. In addition, because issues were formulated based on the existing operations of profit-making businesses, the resolution of societal challenges was often left out of the main objectives.

This led Hitachi to research an approach called "greenfield opportunities," in which businesses are developed from the perspective of future change scenarios that capture macro trends in society. Greenfield opportunities are future narratives that extend beyond the bounds of business-as-usual, taking place in a future where society and markets are different from what they are now[1]. They are created by crossing quantitatively predictable statistical data, such as demographic changes, with qualitative survey data, such as interviews with extreme users who may anticipate future changes in values and lifestyles[2].

In the past, greenfield opportunities have often been used as a catalyst for discussions with stakeholders, but issues had not yet been established from which new businesses could be seeded. Hitachi has developed a new method, based on its belief that if new issues can be identified based on greenfield opportunities created on the premise of issues that will become more serious or more apparent in the future, it will be possible to develop businesses that not only improve productivity and profits in the immediate future, but also solve societal challenges and lead to the creation of future demand.

3. Issues when Developing Businesses Starting from Greenfield Opportunities

However, with greenfield opportunities, it is difficult to identify issues simply by reading completed future scenarios. There are two reasons for this.

First, there is a large gap between the information known by the producer and the information obtained by the receiver in the greenfield opportunity. A vast amount of information is gathered to develop greenfield opportunities, but much of it is omitted after completion, leaving only representative findings and data in most cases. As a result, only superficial findings are conveyed, and when used for business development, it tends to generate proposals that merely go with the flow, such as simply converting the description of a greenfield opportunity to a current business. For example, "From ownership to usership," Sign 6 of Hitachi's 25 Future Signs (hereinafter "Sign 6"), published by Hitachi in 2012, points out that people are beginning to place more emphasis on experience value and its sharing[3]. However, trying to use this greenfield opportunity as-is for a new business would result in a business plan that converted a one-time fee business into a sharing service, regardless of the characteristics of the product and the issues faced by customers. Therefore, to avoid superficial use of greenfield opportunities, it is necessary to have a deep understanding of their background and context, and to have a process that encourages the identification of issues that customers will truly face in the future.

Second, the content of the greenfield opportunities is difficult to personalize. A sense of mission and sense of ownership have been pointed out as two of the most important factors in implementing new businesses[4]. Greenfield opportunities that capture the signs of change are, by their nature, unknown worlds that have not yet arrived for many people, making it difficult to empathize with them and difficult to find topics and issues to be enthusiastic about. Sign 6, with which most people today would agree, was a new idea to many at the time.

In other words, the greenfield opportunities are too brief and too abstract as they are, and for most people they are too distant from their current businesses and their current values. Simply defining the greenfield opportunity does not automatically generate business, and the process after defining the greenfield opportunity is as important as its content.

## 4. Process of Creating a Business from a Greenfield Opportunity

This process can be divided into three steps: understanding the greenfield opportunity, personalization, and issue identification.

Step 1 is gaining a deep understanding by reliving the defining of the greenfield opportunity. By collecting articles and statistics related to the greenfield opportunity and sharing and discussing them within the team, it is possible to deepen understanding of the extent to which the changes indicated by the greenfield opportunity will expand and continue. For example, Sign 6 provides an example of the change in the number of car-sharing vehicles in Japan. In this step, the team discusses the essence of the greenfield opportunity by citing similar examples such as new communication among young people on social media, housing, and furniture sharing services. This will deepen the team's understanding of whether the changes indicated are fundamental and irreversible value changes or transient fads.

In step 2, personalization, team members write down as many experiences as they can think of about themselves or someone close to them related to the greenfield opportunity, and share them with the team. This allows them to understand greenfield opportunities that seemed distant and unconnected to them as relevant. Since the greenfield opportunities depict advanced examples of the world and the possibility of future change, it may be difficult to find a perfectly applicable experience, but if the selected greenfield opportunity adequately captures the changes in the world, all team members should be able to think of one experience in which they felt the signs of such changes. It is important to mention as many experiences as possible without worrying about strict agreement. For example, in the case of Sign 6, it can be an experience other than the exact experience of using a sharing service, such as borrowing and lending comic books or games as a child. In this step, it is important to realize that the greenfield opportunity is not a topic about

Figure 1 — Image of Actions in AM-One New Business Development Project

Based on the greenfield opportunities developed by AM-One in FY2020, issues and personas were identified, and service ideas were developed. In the second half of the process, the business model and the monetary aspects and structural elements of the service were examined.
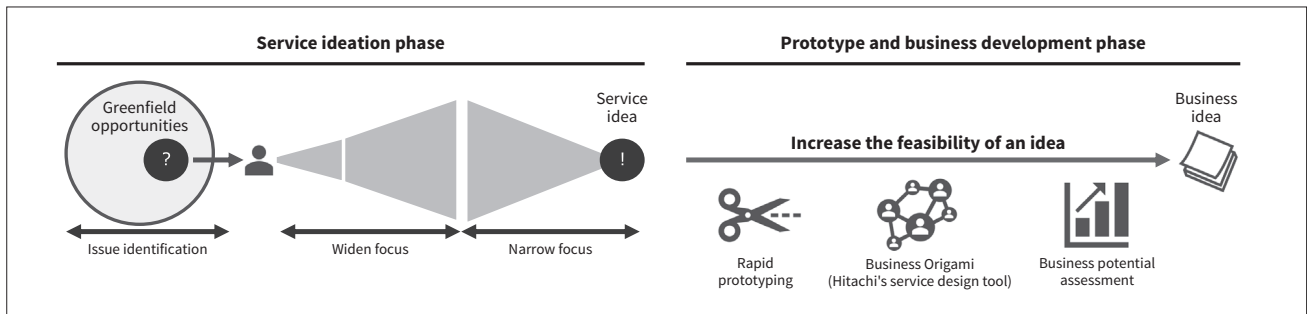
something far away, but something that is relevant to them, and to deepen their imagination until they can empathize with the involved characters when it comes to fruition.

The third and final step is to identify issues and needs from the experiences. Based on each of the team members' experiences shared in step 2, or by imagining a world in which the greenfield opportunity is realized, the members prepare lists of the issues and needs that would exist in this world. If they can understand the greenfield opportunity deeply at this step and can personalize and imagine the feelings and actions of the people who appear in it, they can uncover a number of issues and needs. For example, in the case of Sign 6, they could see new societal challenges caused by excessive sharing of experience value, called "social media fatigue," which is currently a problem among young people.

5. Application Example for Asset Management One

The following is a case study of the application of this methodology to a project with Asset Management One Co., Ltd. (hereinafter AM-One). AM-One is one of the largest asset management companies in Asia, with approximately JPY60 trillion under management as of March 31, 2022.

However, the business environment is rapidly changing with the rise of online brokerage firms and the increase of people with new values such as Generation Z. The number of individual shareholders by age according to the Japan Securities Dealers Association (JSDA) has remained stagnant at around 13 million from 2014 to 2019. The age breakdown has remained almost unchanged, with those ages 60 and above accounting for nearly half of the total, or about 6 million people[5], and the Japan domestic investment market is expected to shrink in the future.

AM-One has therefore initiated a new project to stay ahead of these changes. The goal of this project was to create a customer-oriented service that communicates the value of investment to the approximately 80% of consumers (in 2020, AM-One survey) who do not engage in investment activities and encourages optimal investment for each individual.

AM-One has developed its own greenfield opportunity

as a starting point for its own business development. The company explored the possibility of future changes in people's values through a survey of megatrends, which are changing trends in society, and interviews with users who are seen as practicing new values and lifestyles.

From FY2021, Hitachi has supported the design and operation of the project, and developed new businesses using greenfield opportunities. An image of how the project was conducted is shown in **Figure 1**.

First, workshops were designed by both companies, actually utilizing the methodology presented in the previous section. Workshops were held on a weekly basis and were attended by AM-One employees who responded to an open invitation.

The first workshop was devoted to basic understanding, such as receiving explanations from the members who developed the greenfield opportunities, asking questions, and discussing their impressions. Also, homework was assigned to prepare for steps 1 and 2 for the next week's workshop. In other words, each participant prepared in advance at least three articles or statistics related to a greenfield opportunity, as well as at least three of his/her own experiences, and presented them to each other during the next workshop. As the articles and statistics were explained, team members listening to the explanations wrote their own ideas on sticky notes to deepen their understanding of how irreversible or serious the changes and societal challenges presented in the greenfield opportunity were, and discussed them among themselves. Next, when sharing their experiences, members imagined what issues, anxieties, and frustrations existed in their experiences, or what issues would arise when such experiences increased in the future, and wrote down as many issues as possible (see **Figures 2** and **Figure 3**).

As a result of the above application, it became clear that, in addition to the above-mentioned deep understanding and personalization of the greenfield opportunities, this process has the advantage of facilitating understanding among team members. By sharing their own experiences and talking about the distance between multiple greenfield opportunities and themselves, team members were able to share their interests and backgrounds quickly and

Figure 2 — Example of Step 1 Homework

For example, in the case of greenfield opportunities related to side jobs, statistics on the main occupation income of current Japanese side-job holders are examined. The content of the research should be entered in the "Facts" field, and the hypothesis developed from the facts should be entered in the "Speculation" field.

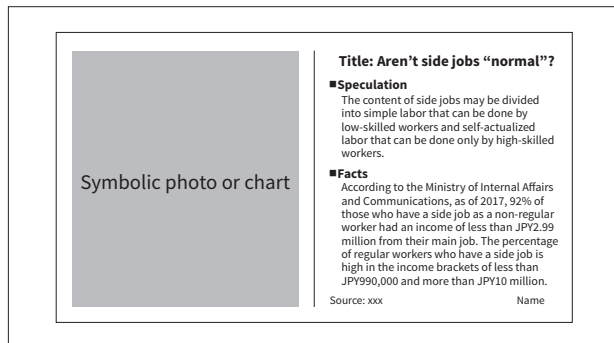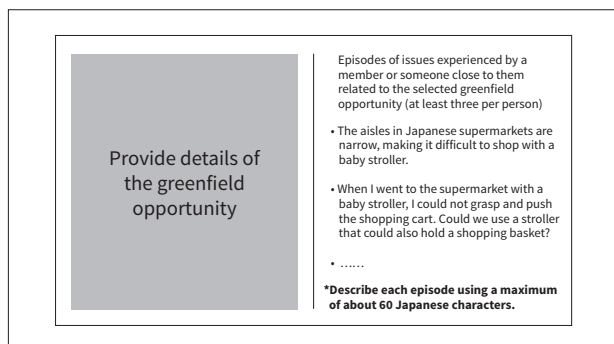|	**Title: Aren't side jobs "normal"?**
	■**Speculation**
	The content of side jobs may be divided into simple labor that can be done by low-skilled workers and self-actualized labor that can be done only by high-skilled workers.
Symbolic photo or chart	■**Facts**
	According to the Ministry of Internal Affairs and Communications, as of 2017, 92% of those who have a side job as a non-regular worker had an income of less than JPY2.99 million from their main job. The percentage of regular workers who have a side job is high in the income brackets of less than JPY990,000 and more than JPY10 million.
	Source: xxx Name

Figure 3 — Example of Step 2 Homework

For example, in one assignment, the issues faced by households balancing work and child rearing are described as concisely as possible in about 60 Japanese characters, based on actual experiences. The process of writing only a brief summary of the main points is an exercise for the subsequent workshop where sticky notes are used.

	Episodes of issues experienced by a member or someone close to them related to the selected greenfield opportunity (at least three per person)
Provide details of the greenfield opportunity	• The aisles in Japanese supermarkets are narrow, making it difficult to shop with a baby stroller.
	• When I went to the supermarket with a baby stroller, I could not grasp and push the shopping cart. Could we use a stroller that could also hold a shopping basket?
	• ......
	***Describe each episode using a maximum of about 60 Japanese characters.**

efficiently. For example, one member opened up about her concern about not being able to talk to her family about their nursing care. When greenfield opportunities were used as a starting point, team members found it easier to talk about topics that would be difficult to talk about when no discussion topic was provided.

The team was then reorganized according to the interests that were identified and delved deeper into issues that all team members were enthusiastic about. The best issues were selected from the three perspectives of importance, versatility, and the proposer's passion, and the process then proceeded to service creation, including persona design and idea generation.

The developed idea was highly evaluated by AM-One executives as one that would lead to the creation of new investment demand and solve societal challenges, and successfully advanced to the development process.

6. Conclusions

This article introduced the process of utilizing greenfield opportunities and identifying new issues.

As new and urgent societal challenges are emerging every day in various countries and regions, it will become increasingly important for many companies and societies to anticipate the emergence and seriousness of these issues and to propose solutions in advance. Going forward, Hitachi will further increase the number of cases applying this methodology and research more effective methods than ever before.

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Digital Solutions for a Sustainable Society

Modern society faces a variety of challenges, including climate change, an aging society with a declining birthrate, and an aging social infrastructure. A multifaceted approach is required to solve these issues and build a sustainable society. In response, the Hitachi Group is working to solve societal challenges through DX by delivering products and solutions that make maximum use of the latest technologies. This section introduces Hitachi's solutions for solving diversifying societal challenges, such as collaborative schemes for decarbonization and CO_2 emission simulations for addressing climate change, challenges in the healthcare field to enable people to have safer, more comfortable, and healthier lives, digital technologies to support maintenance of social infrastructure, and services to support business decisions by visualizing these efforts.

ESG Management Support Service for Sustainable Management

Along with companies becoming more conscious of sustainable management, the growth of ESG investment over recent years has made it more important that the relevant information be disclosed to investors. As a timely response to changes in the rules governing such disclosures is also called for, a lot of human effort and time goes into the collection and collation of large amounts of ESG information, which comes in many different forms and is dispersed across different organizations and countries. In response, Hitachi has developed a service that helps companies pursue sustainable management by streamlining the tasks of collecting, presenting, and analyzing ESG information. This article describes the goals and features of this service.

Makoto Yamaguchi
Kosuke Sasaya
Kotone Yamaguchi

1. Introduction

Integrated reporting has arisen as a means of presenting management strategies in terms of both the financial and non-financial conditions of companies, as laid out in the 2013 International Integrated Reporting Framework.

More recently, in the 2020s, there has also been an acceleration of action on the standardization and formalization of non-financial information disclosure. Examples include work on standardizing the disclosure of financial information relating to climate and sustainability, especially by the International Financial Reporting Standards[1] (IFRS) Foundation, the introduction of regulations in the European Union (EU) based on its Corporate Sustainability Reporting Directive[2], and more extensive non-financial information disclosure requirements from the Securities and Exchange Commission in the USA.

One of the challenges when collecting large amounts of different types of environmental, social, and governance (ESG) data is that it takes a lot of work. It also requires dealing with data formats that differ between organizations and nations while maintaining data consistency when organizations restructure or merge and responding quickly to changes in the topics covered by ESG disclosures. To address this, Hitachi has developed its ESG Management Support Service (MSS) to make collecting, presenting, and analyzing ESG data more efficient and to support digital transformation (DX) in ways that facilitate sustainable management. The service was launched in January 2023 (see **Figure 1**).
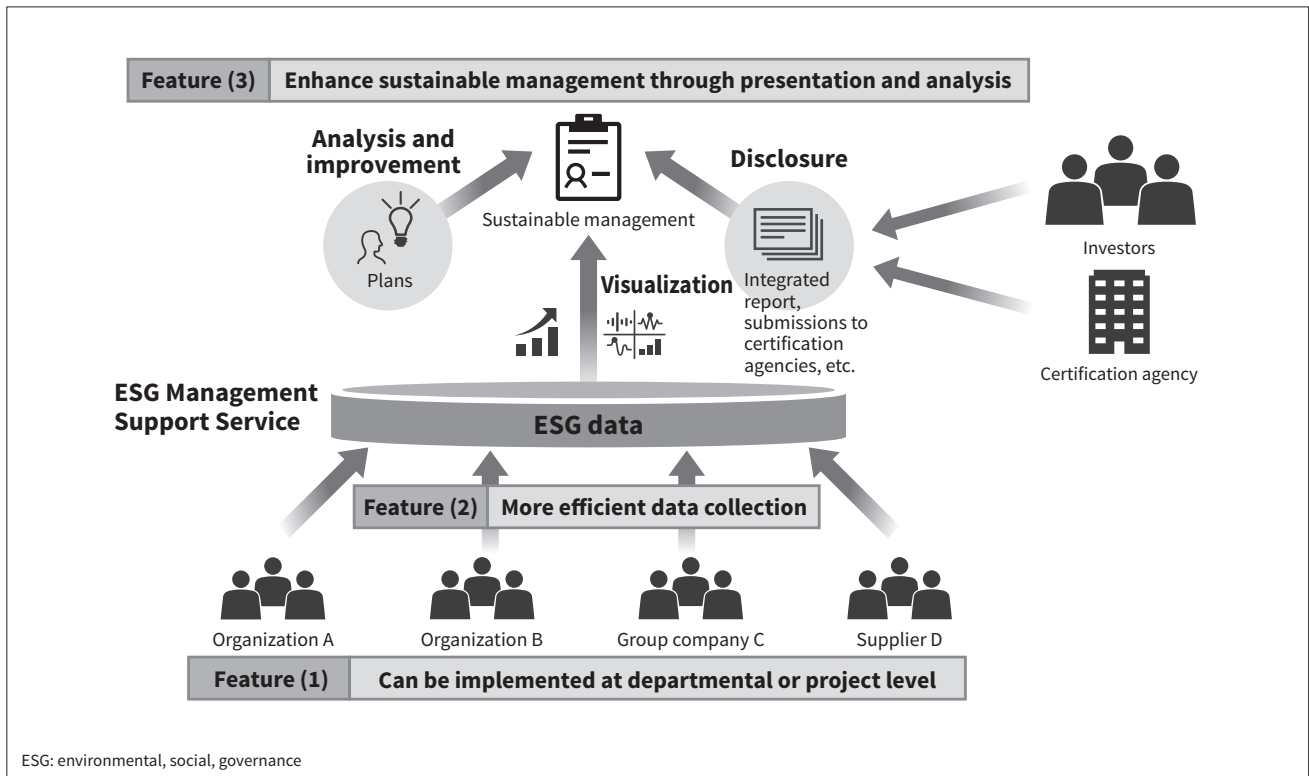
This article describes the challenges that arise when establishing a platform for information collection and how these are addressed by the functions of the ESG Management Support Service.

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*1 Accounting standards formulated by the International Accounting Standards Board.

*2 A law stipulating requirements for reporting on issues ranging from environmental sustainability and societal rights to human rights and governance.

Figure 1 — Concept Diagram of ESG Management Support Service
Rather than being implemented on a company-wide basis, use of the service can be targeted at smaller operational units, such as specific departments or projects. It eliminates human inefficiencies, delivers greater transparency in the collection process, and supports the presentation of collected data.

Feature (3) Enhance sustainable management through presentation and analysis

Analysis and improvement
Plans
Sustainable management
Disclosure
Visualization
Integrated report, submissions to certification agencies, etc.
Investors
Certification agency

ESG Management Support Service
ESG data

Feature (2) More efficient data collection

Organization A
Organization B
Group company C
Supplier D

Feature (1) Can be implemented at departmental or project level

ESG: environmental, social, governance

2. Challenges of ESG Information Collection and Functions of ESG-MSS

2.1
Challenges of ESG Information Collection

While efforts to collect ESG information have accelerated in recent years, the methods for doing so have not kept pace. At many companies, it involves the following sequence of steps.

(1) A senior manager uses a spreadsheet to define the format for collecting data.

(2) The manager sends an e-mail to subordinates with the spreadsheet attached.

(3) Where necessary, these subordinates send a similar e-mail to their own subordinates.

(4) The staff assigned to carry out these requests go about collecting the required information, manually entering it into the spreadsheet in the specified format, and returning it, again as an e-mail attachment.

(5) The manager reviews the received file, consulting with staff members where necessary to correct any data entry errors and resolve any uncertainties.

(6) When all the data has been obtained from subordinates, it is collated in the specified format and returned to the person who requested it.

Hitachi has identified the following three issues with collecting data in this way.

(1) Lack of information literacy

Many companies use spreadsheets for entering and managing data and e-mail for communications. This is because dedicated information collection systems cannot cope with changes to the data being collected, requiring modifications when new data is added, and because companies lack the budget to build such systems.

(2) Lack of consistency in information collection formats

Differences in the formats used by parent and subsidiary companies, or across different departments within the same company, mean that preparing reports takes a lot of work, with managers having to map data items to the reporting template manually.

As the scope of information collection expands, it often creates a need for modifications to existing systems and services. Given the time and expense involved, companies are unable to implement changes to collection formats quickly.

(3) Manual data entry checks

While spreadsheets come with a certain level of error checking, such as detecting when text is present in a numeric field or an incorrect range has been specified for calculating a total, there are many instances where these checks fail to identify mistakes in manually created spreadsheets, such as missing settings or incorrect ranges.

2. 2
Development of ESG-MSS

Based on the issues identified, Hitachi commenced development of the ESG-MSS in April 2022, recognizing the urgent need for such a service to support collection functions.

The functions to be developed were split into four groups based on how users go about collecting data. These were: (1) Registration of template, (2) Management of contact lists, (3) Collection requests and reception of answer forms, and (4) Analysis (see **Figure 2**). The MSS was limited to the provision of data, with customers using business intelligence (BI) tools such as PowerBI[*3] for analysis.

To ensure that the service can be delivered in a way that fits with how customers use it, the scope of data collection work is split into separate "tenants" and service contracts are offered on a tenant-by-tenant basis. This provides flexibility in service configuration, supporting both large and small implementations.

The main MSS functions are as follows.

(1) Registration of template

This function defines the data to be collected. The field name (English and Japanese), data type, and data entry rules (upper and lower limits) for each item are specified in a spreadsheet and registered in the MSS. This is then used to generate the schema for storing data in the MSS and the answer form file [described in (3) below] for collating the collected data. When the information collection request function is executed, the schema generated from the template is used to create the database schema in the data lakehouse (Databricks[*4]) that stores the data in the MSS. As this database schema is updated whenever a user adds fields or otherwise modifies the template, such changes can be made at any time.

(2) Management of contact lists

This function manages the contact lists used to send out collection requests by e-mail.

Circumstances such as corporate mergers and acquisitions or changing business conditions result in organizational changes, and personnel transfers lead to renaming of departments or reassignment of responsibilities. As information may be requested from tens or even hundreds of people, large departmental reorganizations or changes in the contact network generate a lot of work.
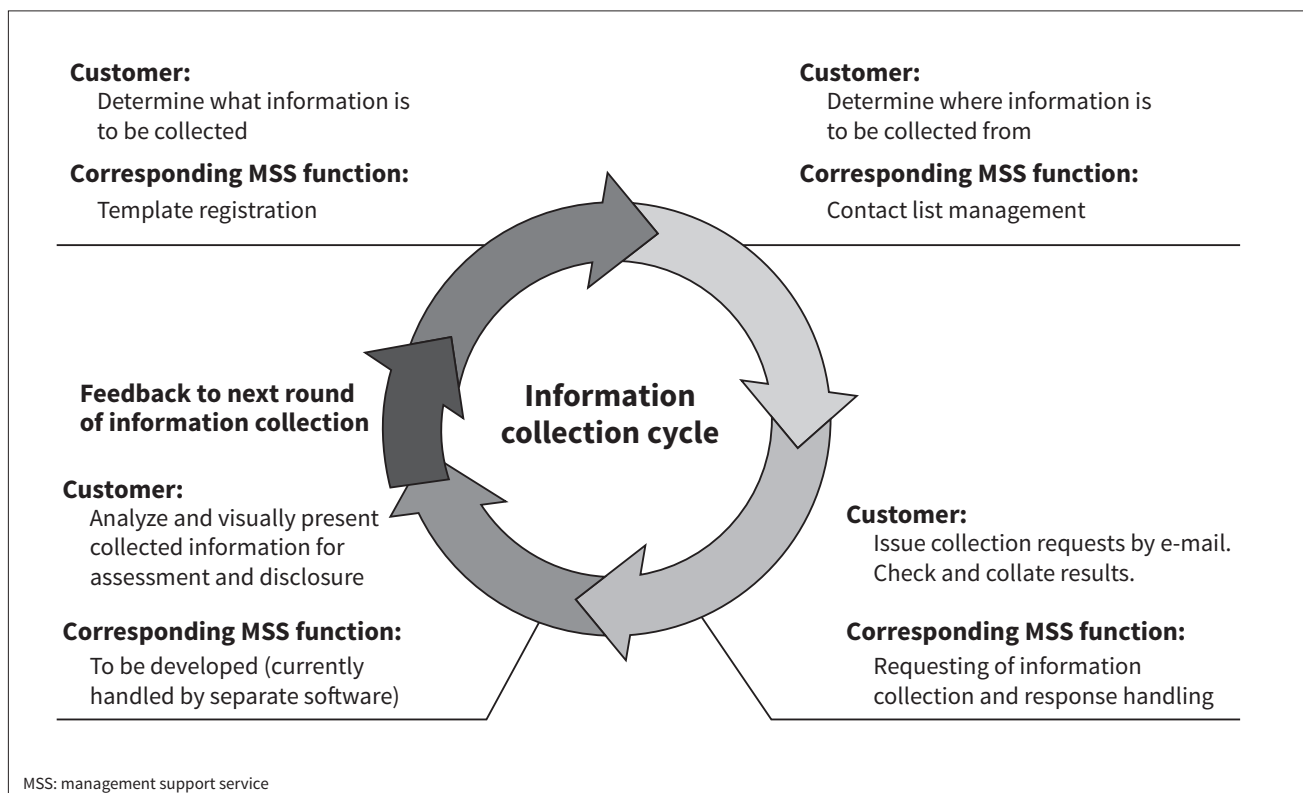
By providing a way to update contacts automatically by coordinating the contact lists and information about

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*3 PowerBI is a registered trademark of Microsoft Corporation.

*4 An integrated environment that provides the functions required for using data in the cloud, including data collection, archiving, artificial intelligence (AI), analytics, and visualization. Databricks is a registered trademark of Databricks Inc.

Figure 2 — Four Types of Functions Provided by ESG Management Support Service

Information collection can be divided into four blocks: (1) Define information to be collected, (2) Determine where information is to be collected from, (3) Collect and return the required information, (4) Analyze and present the collected information. This service improves efficiency by providing the functions needed for each block.

Customer:
  Determine what information is to be collected
Corresponding MSS function:
  Template registration

Customer:
  Determine where information is to be collected from
Corresponding MSS function:
  Contact list management

Feedback to next round of information collection
Customer:
  Analyze and visually present collected information for assessment and disclosure
Corresponding MSS function:
  To be developed (currently handled by separate software)

Information collection cycle

Customer:
  Issue collection requests by e-mail. Check and collate results.
Corresponding MSS function:
  Requesting of information collection and response handling

MSS: management support service

the people in charge across different tenants, the function for managing contact lists makes it easy to reorganize the contact network.

(3) Collection request and reception of answer form

The template and contact lists created by the above functions are combined into an information collection request package. When a collection request is issued, an email is sent requesting action by each of the designated contact people with the answer form generated from the template included as an attachment.

The recipients fill out the attached answer form and return it in their e-mail reply. The MSS then checks this file and the data it contains based on the data entry rules in the template. If errors are found, the person who provided the information is notified. If not, the data is updated in the MSS.

3. Conclusions

This article has described how Hitachi has addressed the difficulties companies face when collecting information, developing functions for a service that utilizes companies' existing tools and works the same way as their existing data collection practices.

In the future, Hitachi intends to expand the service with additional functions that will allow its use for information collection by more companies.

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Omika Green Network: Co-creation of Decarbonization with Growth from a Regional Perspective

Amid accelerating moves toward decarbonization around the world, companies and industries are faced with the difficult societal challenge of achieving carbon neutrality not only within companies, but also across entire communities and supply chains. To address this challenge, Hitachi Ltd.'s Omika Works has established the Omika Green Network for achieving carbon neutrality, putting the technologies and knowledge gained from GX initiatives at the site to work in local communities and companies in the supply chain while also building a social infrastructure ecosystem made up of many other stakeholders who face similar challenges. This article describes the concepts behind the Omika Green Network and how they are being implemented in practice.

Naohiko Irie, Ph.D.
Etsuko Iwama
Ryu Morichi
Naoko Ochi

1. Introduction

Hitachi is pursuing "Hitachi Environmental Innovation 2050," a set of long-term environmental targets that it has adopted to achieve a "decarbonized society," "resource-efficient society," and "harmonized society with nature"[1]. For decarbonization, it has announced goals of achieving carbon neutrality at its workplaces (factories and offices) by FY2030 and throughout its entire value chain by FY2050. To accomplish this, it will be necessary to overcome the difficult societal challenges posed by carbon neutrality, not only within Hitachi, but also in local communities and companies in the supply chain.

The issues that companies and workplaces will need to address if they are to achieve carbon neutrality include that of combining economic and environmental value in ways that do not compromise business continuity and growth, the procurement and coordination of renewable energy in ways that can cope with energy price fluctuations and the need to balance supply and demand, and the establishment of frameworks for the co-creation of decarbonization that

extend in scope across local communities and supply-chain companies.

This article reports on what Hitachi Ltd.'s Omika Works is doing to address these challenges.

2. Omika Green Network for Decarbonization

Omika Works was established in 1969 in Omika-cho, Hitachi City in Ibaraki Prefecture. With deep roots in the community, the site specializes in variable-mix, variable-volume production, having engaged in the design, manufacture, development, and maintenance of information and control systems for social infrastructure, including electricity, railways, and water and sewage. While its history goes back 50 years, the site has been reforming its production practices over the past 20 years through the "plan, do, check, act" (PDCA) cycle and a highly efficient production model that uses the Internet of Things (IoT) to collect, analyze, and utilize human, machine, material, and method (4M) data, including the movements of people and the operation of machines. By doing so, it has reduced production lead times for key products by more than 50%[2].

In addition to the installation of photovoltaic panels and storage batteries as part of its response to the Great East Japan Earthquake, Omika Works also utilizes an energy management system (EMS) and electricity usage data from sensors located at around 900 locations across the site to conserve, generate, and store energy. Moreover, energy efficiencies achieved through interoperation between the EMS and production planning have cut the contracted power consumption by approximately 29% while also reinforcing business continuity planning (BCP). This has included reductions in peak electricity demand, control of the photovoltaics together with the charging and discharging of batteries, and autonomous control.

In recognition of these efforts, including its work on production and energy management, the site was selected as a "Lighthouse" by the World Economic Forum (WEF) in January 2020[3]. Lighthouses are sites identified by the WEF as advanced manufacturing factories that are leading the way to the Fourth Industrial Revolution. Omika Works was the first such factory owned by a Japanese company and located in Japan to receive this recognition.

Drawing on this knowledge of the digital transformation (DX) of factory operations through production and energy management, Omika Works has now embarked on efforts to overcome the difficult societal challenges posed by carbon neutrality, not only at its own site, but also in local communities and supply-chain companies. However, as this is not a goal that any one company can achieve on its own, Hitachi has also established the Omika Green Network to work on improving decarbonization capabilities with a range of other stakeholders facing similar challenges, including companies, public agencies, education and research institutions, and the finance industry[4].

In the Omika Green Network, Omika Works acts as a hub or field for experimental verification of a wide variety of decarbonization initiatives, with the knowledge thus gained being shared with other supplier companies, local businesses and communities, financial institutions, public agencies, technology providers, customers, and others. The goal is to use co-creation to achieve carbon neutrality through green transformation (GX) (see **Figure 1**).

2. 1
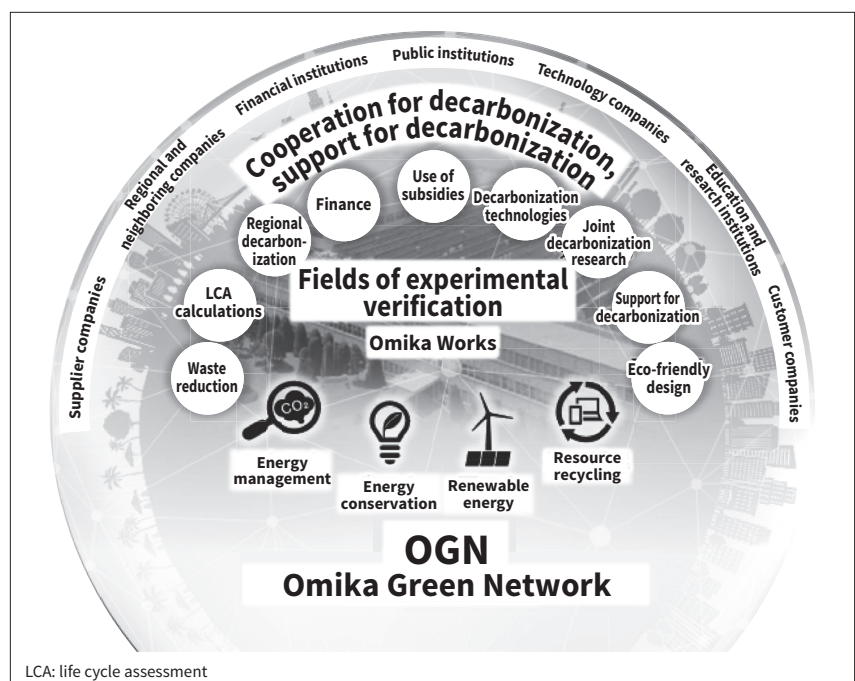### Achieving Carbon Neutrality at Omika Works

The first step is the promotion of GX experimental verification aimed at achieving carbon neutrality at Omika Works.

This involves creating a digital twin for decarbonization by mapping the workplace 4M and environmental data that has been collected at Omika Works. By utilizing EMS data and the power sensors located at around 900 locations across the site, this provides building-by-building information about carbon dioxide (CO_2) emissions and can be used to work through the PDCA cycle of estimating potential reductions, developing a roadmap, and measuring actual performance. To increase the use of renewable energy sources, a model of the site electricity network is also used to simulate fluctuations in electric power. Similarly, product-specific CO_2 emissions are assessed from a combination of production line, design, and other data. In this way, use of the decarbonization digital twin allows for an ongoing cycle of testing and implementing new ideas for reducing emissions.

The results of this GX experimental verification are collated in the "Omika GX model," which is then put to use not only at Hitachi, but also by customers and other partners.

Figure 1 — Conceptual Diagram of Omika Green Network

As it works to overcome the shared challenge of achieving carbon neutrality, Hitachi is using Omika Works as a hub or field for experimental verification of green transformation initiatives that involve co-creation with stakeholders.

LCA: life cycle assessment

2. 2

Achieving Carbon Neutrality in Local Communities and Supply-chain Companies

The next step is the horizonal deployment of the results of GX experimental verification to local communities and supply-chain companies.

Among the important requirements for carbon neutrality are the use of renewable methods of energy generation that emit very little CO_2 while making full use of energy storage to maintain a reliable supply of electric power. Given the limits to how much energy generation and storage infrastructure any one company can install on its own, mechanisms such as off-site power purchase agreements (PPAs) for the procurement and optimal use of green energy are essential. Moreover, while balancing electricity supply and demand is another prerequisite for the reliable supply of electric power, controlling the weather-dependent output of renewable energy sources such as photovoltaics and wind is extremely difficult.

Hitachi has a track record of supplying solutions for the distributed control of electric power in Japan and elsewhere and is utilizing this technology in trials at other nearby sites in the Ibaraki region with a view toward application over a wider area in the future. As well as incorporating this expertise in green energy management into the Omika GX model, Hitachi is also aiming to expand the local use of renewable energy by establishing a framework in the form of a regional energy management platform designed to work with cross-regional electricity supply and the balancing market.

Other efforts associated with supply chains include consolidating the data needed to estimate CO_2 emission volumes across entire supply chains and the establishment of an environmentally trusted digital platform for supporting environmental management in partnership with financial institutions and local government. In this way, Hitachi is building a data-driven ecosystem made up of supply chain stakeholders and using real-world data and activities to trial decarbonization initiatives.

Activities in partnership with stakeholders are already underway. A consortium that includes Hitachi City companies and the Regional Technical Support Center has been established to promote decarbonization management in small and mid-sized businesses. As a responsible business with roots in the local community, Omika Works is also participating in the consortium, which is encouraging decarbonization by local small and mid-sized businesses and underpinning emission reduction efforts, offering ways of utilizing its digital technology and knowledge to estimate, publish, and reduce Scope 3 emissions. As it works to achieve decarbonization, Hitachi plans to continue such efforts that combine digital practices with real-world activities.

3. Conclusions

While many companies have announced their intentions to become carbon neutral, few have yet come up with a road map of practical measures for achieving this across their supply chains. Even when it comes to achieving carbon neutrality in factories and offices, generic solutions are difficult to come by. While there are many useful examples of companies estimating and publicizing their CO_2 emissions, going on to implement actual emission reduction measures requires in-depth consideration of such factors as the investment cost and how such actions will fit into their growth strategies.

Figure 2 — Social Infrastructure Ecosystem Envisaged by Omika Green Network

Hitachi is building a social infrastructure ecosystem as a way to take on the grand challenge of achieving carbon neutrality both in local communities and in supply-chain companies.

PPA: power purchase agreement GX: green transformation
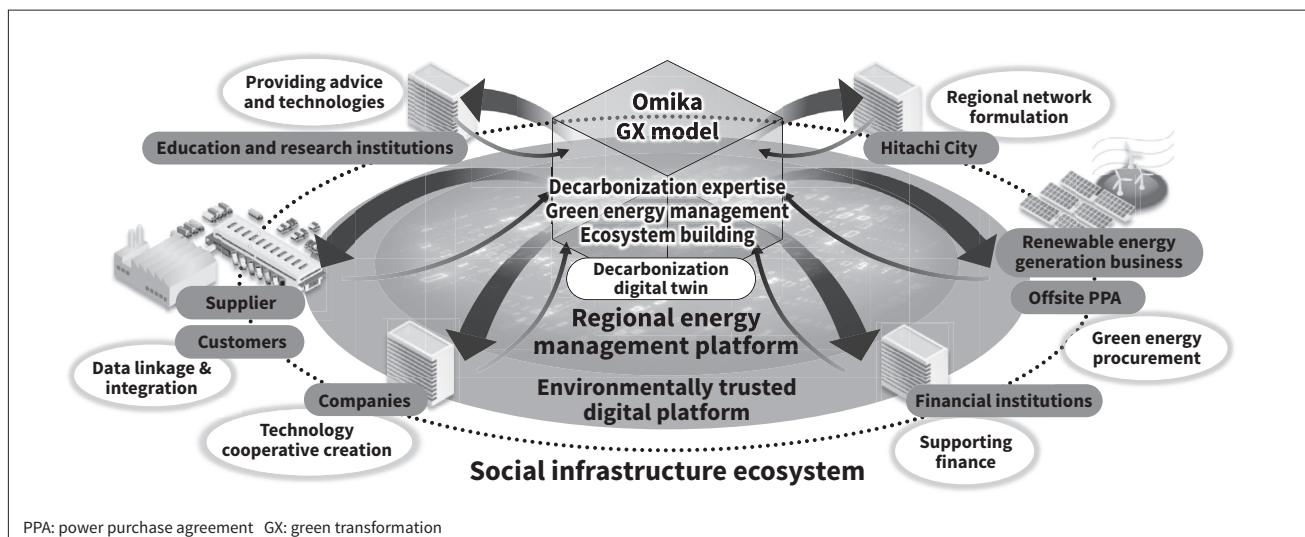
Given these circumstances, Omika Works has been considering ways to confront the challenge of carbon neutrality head on, both in its factories and in local communities. Through the Omika Green Network, Hitachi intends to continue sharing with its many stakeholders both the portfolio of technologies and knowledge for the digital transformation of plant management built up at its Omika Works hub and what it has learned from experimental verification of GX practices for environmental management. Likewise, it will continue to build its social infrastructure ecosystem with the goal of achieving carbon neutrality across local communities and supply-chain companies while also supporting the formulation of company-specific scenarios for decarbonization (see **Figure 2**).

This work is extending beyond Hitachi City to encompass a number of other regions. One example is the launch of new services[5] where Hitachi partners with regional banks to support decarbonization efforts by small and mid-sized businesses as they work toward achieving carbon neutrality by 2050.

Hitachi intends to continue with its efforts to overcome the grand challenge of achieving carbon neutrality across all areas of society, leveraging the locally developed social infrastructure ecosystem of the Omika Green Network as one way of doing so.

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Global Supply Chain Simulation Service to Support Supply Chain Strategy

Manufacturers and other companies will need to decide soon how they intend to reach carbon neutrality if this goal is to be achieved by 2050. It is crucial that they find ways to reduce CO_2 emissions while remaining profitable and continuing to invest amid a changing external environment that includes price inflation and shortages of raw materials and energy. This article describes how a Global Supply Chain Simulation Service from Hitachi Solutions, Ltd. helps companies formulate supply chain strategy, including the application of numerical techniques to optimize both profitability and CO_2 emissions reduction.

Yasuhiro Ozawa

1. Introduction

Decarbonization initiatives have been getting underway in earnest around the world since the adoption of the Paris Agreement at the 21st UN Climate Change Conference of the Parties (COP21) in 2015. Whereas efforts had previously been confined mainly to developed nations, the Paris Agreement marked a shift to action by all 196 nations participating in the UN Framework Convention on Climate Change. With Europe in the vanguard, more than 150 nations made pledges to achieve carbon neutrality by a given date over the years that followed. As of the end of COP26 in 2021, the countries or regions that had made such pledges accounted for 88.2% of total global carbon dioxide (CO_2) emissions. Japan, too, is accelerating its activities, having announced its own 2050 target for carbon neutrality in October 2020.

The two key areas that companies need to address in order to achieve carbon neutrality are the visualization and reduction respectively of CO_2 emissions. While there are many examples of the former being achieved using digital technology, instances of actual emissions reduction are rare. The visualization of emissions to better understand the current situation is important, however, measures that deliver actual reductions matter even more. So, the use of digital technology to reduce CO_2 emissions is expected to become an important issue for society as a whole (see **Figure 1**).

Reducing CO_2 emissions involves measures that come with capital and other associated costs. The electrification of plants, for example, is one of the measures recommended for emissions reduction that requires new investment. The Green Transformation League (GX League), a joint initiative between industry, government, and academia, plans to launch its emissions trading system (GX-ETS) on a trial basis from FY2023. This will require companies that fail to achieve their voluntary reduction targets to purchase offsets on the carbon credit market.

The Global Supply Chain Simulation Service described in this article can predict future CO_2 emissions and assess the effectiveness of proposed reduction measures by using

Figure 1 — Two Key Areas for Corporate Action on Carbon Neutrality
Achieving carbon neutrality calls for action by companies on both the visualization and reduction of CO_2 emissions.
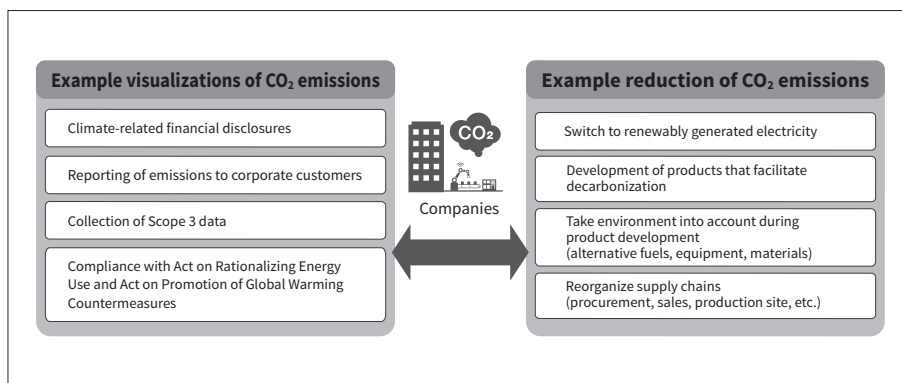
digital twin technology to replicate supply chains in virtual space and simulate production and sales. As the simulation predicts key performance indicators (KPIs) such as sales and profit as well as CO_2 emissions, it helps companies take account of both corporate management and emission reduction considerations when devising strategy.

2. Global Supply Chain Simulation Service

The Global Supply Chain Simulation Service is a cloud-based service developed to improve supply chain resilience. A function for simulating CO_2 emissions was added in April 2022 to facilitate work toward carbon neutrality, providing the ability to predict emissions across the supply chain.

2. 1
Use of Global Supply Chain Simulation Service for Maximizing Profit

The emergence of COVID-19 has brought greater uncertainty. The raw material shortages and price increases, higher fuel prices, and citywide lockdowns of 2022 led to shipping delays and brought on a variety of problems, including geopolitical risk and higher exchange rate volatility. This made the formulation of an appropriate supply chain strategy an issue of great importance for management. The Global Supply Chain Simulation Service uses a predefined supply chain model and master data on sales, production, procurement, and transportation to replicate and simulate a company's supply chain in a digital environment.

The inputs to the simulation are: (1) the supply chain model, (2) procurement data (costs and capacity), (3) plant data (production capacity, bills of materials, fixed overheads, and variable costs), (4) transportation data (costs and tariffs), and (5) demand data (demand, selling prices).

On a technical level, the simulation uses a numerical analysis technique called linear programming. In theory, this technique can calculate the sales and production plan that maximizes company-wide benefits while staying within the constraints imposed by the plant production capacity and the delivery capacity of suppliers. Consider the example of a

company with production facilities for the same product in both Japan and China that needs to manufacture 100 units. To determine the optimal solution (the combination of production and sales that delivers the highest profit), the simulation performs calculations for all possible combinations (making 100 units in Japan and none in China, 99 units in Japan and one in China, and so on…). The outputs include: (1) sales and profit, (2) the product mix and production quantities that maximize profit for a given demand, (3) the product mix and operating times for each item of plant, and (4) the mix and quantities of purchased products.

By defining what-if scenarios, the simulation can also be used to assess future possibilities. One example would be to simulate possible changes in procurement capacity and costs in anticipation of future price rises and shortages of raw materials, using this to determine what impact they might have on the company's sales and profits. This allows for pre-emptive measures as well as prompt action if one of the scenarios eventuates (see **Figure 2**).

### 2. 2
Use of Global Supply Chain Simulation Service for Predicting CO₂ Emissions

This section describes the newly added function for simulating CO_2 emissions. The Greenhouse Gas Protocol (GHG Protocol) has set international standards for calculating and reporting CO_2 emissions at all steps along the value chain. These are divided into three scopes. Scope 1 refers to direct emissions of GHGs by the reporting company (the burning of fuel and other industrial processes). Scope 2 refers to indirect emissions associated with the use of electricity, heat, or steam supplied by other companies, and Scope 3 refers to those indirect emissions not covered by Scope 1 or Scope 2 (emissions that occur at other companies but result from the reporting company's activities)[1].

The Global Supply Chain Simulation Service can simulate CO_2 emissions for Scope 1, Scope 2, and categories 1, 4, and 9 of Scope 3. Category 1 relates to purchased products and services, category 4 to upstream transportation and delivery, and category 9 to downstream transportation and delivery. These three Scope 3 categories were chosen

Figure 2 — Use of Digital Twin in Supply Chain Resilience Strategy

Numerical analysis can assist with the formulation of sales and supply strategies that maximize profitability. The best plan can be identified by comparing different what-if scenarios, using these as a basis for determining the optimal mix of sales and production volumes, allocation (choice of production sites), and purchasing quantities.

BOM: bill of materials
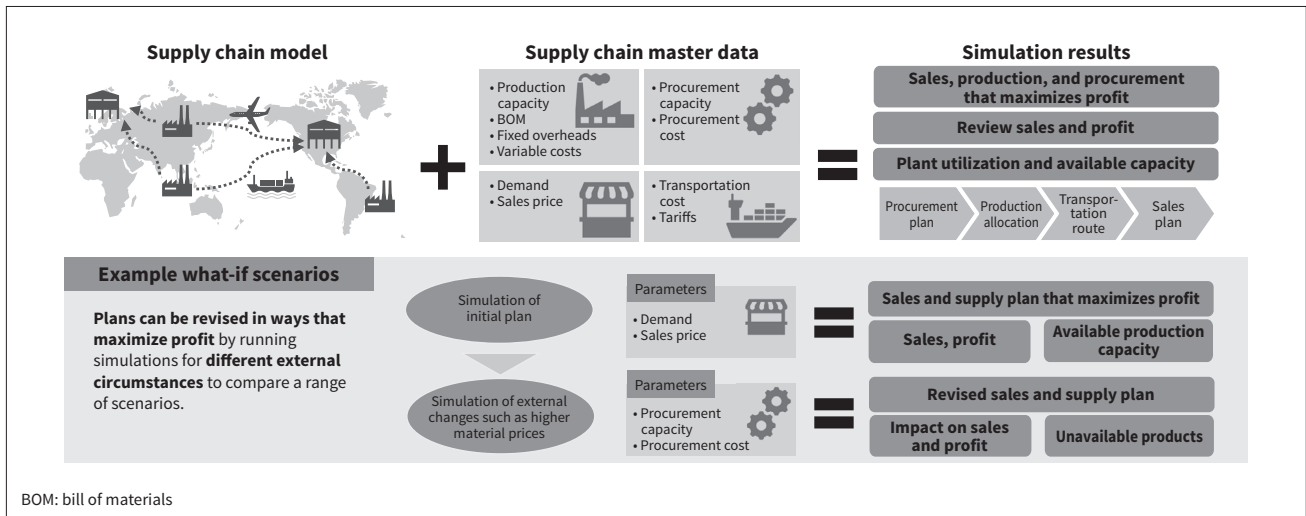
because they are directly influenced by the movement of goods along the supply chain.

The additional information used for simulating CO_2 emissions is: (1) procurement data on the per-unit CO_2 emissions of each purchased product, (2) plant data on the per-unit CO_2 emissions during the production process for end products and intermediate goods, (3) plant-wide Scope-2 CO_2 emissions (electric power use, etc.), (4) transportation data on per-unit CO_2 emissions during shipping and the border carbon taxes levied on the CO_2 amount. The addition of this extra input data allows companies to use the digital twin of the supply chain to simulate how much CO_2 will be emitted by their sales and production plans (see **Figure 3**).

2. 3
Interoperation with ETS

The Global Supply Chain Simulation Service allows companies to participate in emissions trading systems (ETSs) by setting a maximum limit on CO_2 emissions at the company or site level.

The European Union (EU) has introduced one such scheme (the EU-ETS). While this initially allocated free credits based on historic emissions, credits must now be

Figure 3 — How Per-product and Total Supply Chain CO_2 Emissions are Calculated

The Global Supply Chain Simulation Service uses master data on the CO_2 emissions at each step in the supply chain to calculate total and per-product CO_2 emissions.
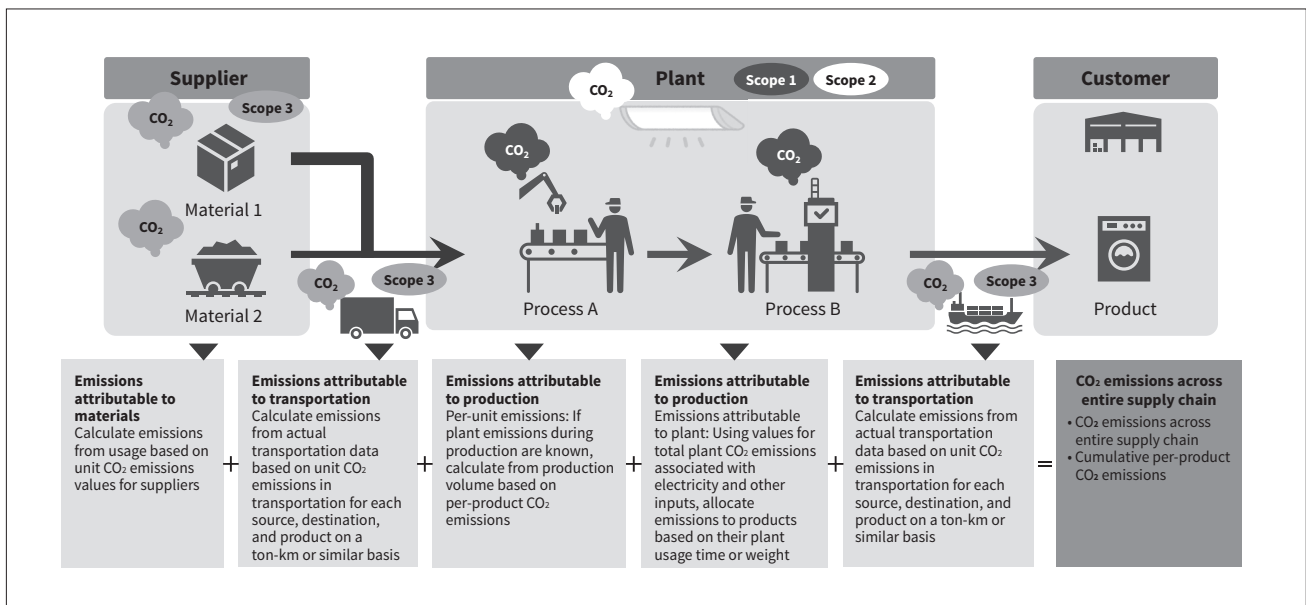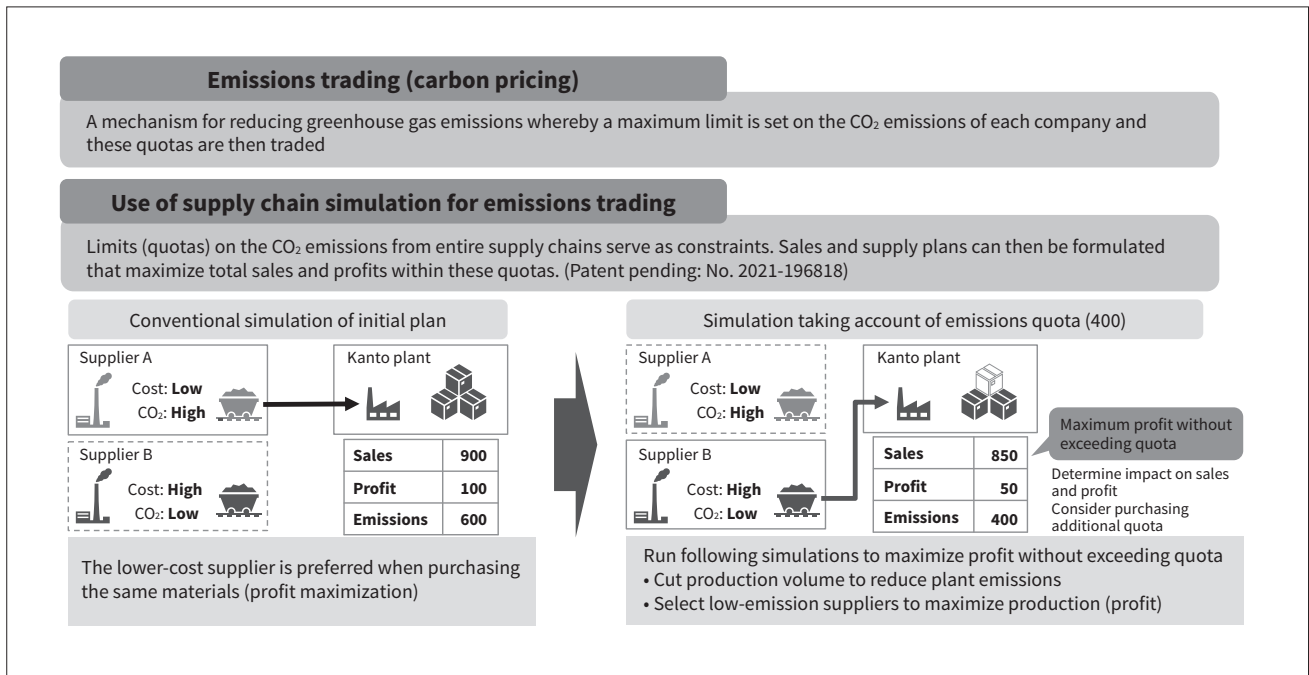
Figure 4 — Interoperation with Emissions Trading (Carbon Pricing)

Utilize linear programming to obtain the production and sales combination that maximizes profit while remaining within the maximum limit on CO_2 emissions.

purchased through an auction. Japan's GX-ETS works by allowing companies that beat their own voluntary reduction targets to sell the excess on a carbon credit exchange while those that fail to meet their targets must purchase offsetting credits from the exchange. A further scheme is also planned whereby a private agency will be commissioned by the government to assess the appropriateness of companies' voluntary reduction targets[2].

It is possible to formulate production and sales plans that maximize profitability while remaining within the maximum limit for CO_2 emissions. Reducing raw material prices is not the only way to improve profitability. Companies can reduce spending on carbon credits by using raw materials that come with lower CO_2 emissions, even if they are more expensive than those of other suppliers. In some cases, they can even achieve higher profits from lower sales. The Global Supply Chain Simulation Service is able to identify such opportunities (see **Figure 4**).

3. Conclusions

A draft of the "Basic Policy for the Realization of GX" with a 10-year roadmap was presented at the fifth meeting of the GX Implementation Council chaired by the prime minister in December 2022[3]. The draft basic policy considered the progressive introduction of auctions for power generators and third-party private-sector certification of corporate reduction targets under the ETS together with the adoption of carbon levies with uniform emissions pricing. It stated

that, rather than adopting such measures immediately, they should be implemented over a period of time set aside for concerted action on GX.

While work toward carbon neutrality to date has mainly involved voluntary corporate initiatives, this push from government is expected to further accelerate activity. In the future, Hitachi intends to utilize the Global Supply Chain Simulation Service to help both companies and wider society achieve carbon neutrality.

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Sustainable Business Model for Overcoming Challenges of Super Aging Society

Improving CX for Elderly

Japan faces a variety of societal challenges, not the least of which is concern about the social security system in the face of a declining population, extremely low birthrate, and aging demographics. The need to step up efforts to address these challenges is urgent. With no prospect of improvement in demographics that are heavily skewed toward older age groups, there is a need for the elderly themselves to take up the task of revitalizing domestic demand and resolving the issues facing the social security system, including rising healthcare costs. Hitachi also believes that making the most of advanced technology to improve CX for the elderly is essential, not only in Japan, which is at the forefront of this trend, but also in other nations where populations are aging. After reviewing current developments relating to how improvements in CX for the elderly can support industrial growth and promote self-sufficiency, especially in relation to the insurance industry and its role of complementing the social security system, this article goes on to describe the new *Shakai Sanka no Susume* (Encouraging Social Participation) service from Hitachi that is based on a smartphone app.

Takeo Endo
Yuji Kamata

1. Introduction

Japan is facing severe societal challenges resulting from its declining population, extremely low birthrate, and aging demographics. One example is the looming "2025 problem," which refers to the rapid increase in social security costs that will happen as everyone in the baby-boom generation reaches the later stages of old age (75 years or older). Five years after that comes the "2030 problem," where the shrinking of the working-age population will strain the limits of the social security system, with one person in three over 65 years of age. It is clear that the longer this trend toward a declining population, extremely low birthrate, and aging demographics continues, the more severe the weaknesses of the social security system will become, with major consequences for citizens of every age group. Some way needs to be found for the nation as a whole to overcome this vicious circle.

Under these circumstances, many elderly people are feeling uncertainty and concern about the three great risks of old age, namely health, finances, and loneliness and isolation, to which can also be added the fourth issue of how the elderly are to be cared for. This latter issue of caring for the elderly poses difficult challenges of its own, including "the elderly caring for the elderly" whereby older people themselves provide care for others who need it. Hitachi believes that encouraging the self-sufficiency is an important factor in overcoming the risks facing the elderly. Were initiatives for providing such encouragement to become more widespread, it would help address the severe societal challenges mentioned above.

2. Importance of Developing Business Models for Improving CX for the Elderly

In Japan, a nation at the forefront of the global trend toward rapidly aging populations, many influential companies are seeking to achieve robust business growth between now and 2030 by working on business models that encourage self-sufficiency among the elderly in ways that address societal challenges. A key to the success of such endeavors is to develop value models that leverage advanced technology to improve customer experience (CX) for the elderly. This article describes leading initiatives from the insurance industry and other related industries that are predicated on extending healthy lifespans, extending asset lifespans, and building personal connections. It also discusses the value that can be derived from such initiatives. The target market for these includes not only those people in early old age (65 and over) and later old age (75 and over), but also others who are approaching retirement age.

2.1
Current Status and Future Directions for Services Using Advanced Technology to Manage Health Risks

A major European insurer with operations mainly in Asian countries that are facing aging demographics similar to Japan is attracting attention. The company is helping these countries address societal challenges by utilizing the capabilities of artificial intelligence (AI), digital twins[*1], and other advanced technologies to provide services based on health data collected by a healthcare app that it supplies to customers. These include monitoring the user's health based on a scoring algorithm it developed, offering timely and appropriately prioritized advice on what actions to take, and video consultations with doctors.

Combining AI with digital twins is a subject of research around the world. Having elderly people create a "second self" that replicates their memories, values, interests, and

preferences, for example, can provide them with someone to talk to, with other possible applications including the provision of advice and encouragement to avoid falling victim to bank transfer scams and other specialized fraud or expressing wishes on their behalf, such as wanting to spend their last days at home. Integrated with the above app-based service, this has the potential to develop into a model for encouraging self-sufficiency among the elderly that also works in a way that improves CX.

Unfortunately, the legal system in Japan poses a number of obstacles to such endeavors, meaning that it would be difficult at present to roll out all of the advanced services of the insurance company app. Nevertheless, along with ways of putting information to use by entities such as the private service providers already working in this area, the launch of better insurance services is also anticipated as progress is made on the use of health and medical information from Japan's Individual Number card (the "My Number" card) and associated portal, the use of which is growing. Further into the future, changes in consumer attitudes are anticipated as wider use of genomic medicine gives people a better understanding of genetic information, with demand for services such as the delivery of genuine extensions to healthy lifespan through better use of data.

2.2
Contribution to Society as Key Factor in Encouraging Elderly Self-sufficiency

Self-help and mutual aid are two key factors when it comes to encouraging self-sufficiency among the elderly. These are two of the four forms of help (self-help, mutual aid, cooperation, public assistance) that feature in community-based integrated care systems for providing services that support the elderly. They are also very closely linked to involvement in activities that contribute to society.

An Internet welfare and health monitor survey was conducted in November 2020 by the Bureau of Social Welfare and Public Health of Tokyo Metropolitan Government. When questioned about their intentions regarding community activity in old age, the second most common choice for what respondents wanted to do after reaching retirement age was "community activities and activities that contribute

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*1 The replication of the physical world in digital space based on collected real-world information. Some experts have predicted that many people will have a digital twin of themselves in the 2030s.

Table 1 — Tokyo Metropolitan Survey of Lifestyle and Activity Intentions after Reaching Retirement Age
This shows the top three responses for respondents age 50 and over (with each respondent asked to choose up to three responses).

Age group	50s (113 respondents)	60s (76 respondents)	70s (85 respondents)
Most popular response	Community activities and activities that contribute to society (volunteering) 47.8%	Hobbies and sports 56.6%	Community activities and activities that contribute to society (volunteering) 72.9%
Second most popular response	Hobbies and sports 46.9%	Community activities and activities that contribute to society (volunteering) 52.6%	Hobbies and sports 67.1%
Third most popular response	Travel and leisure 44.2%	Travel and leisure 51.3%	Travel and leisure 47.1%

Source: Prepared by Hitachi based on information on community activity intentions in old age contained in an Internet welfare and health monitor survey conducted in November 2020 by the Bureau of Social Welfare and Public Health of Tokyo Metropolitan Government.

to society." By age, this was the most common response in the 50s and 70s age groups (and second in the 60s age group), chosen by more than 70% of respondents in their 70s (see **Table 1**). While the survey size was small, receiving 371 valid responses from 500 people surveyed, and while its results cannot be treated as definitive given that it was restricted to the Tokyo area, it does offer an indicative data point. It also seems likely that the introduction of schemes such as the ability to earn consumer loyalty points in return for activities that contribute to society would lead to a sustainable improvement in experience.

The next section describes past work by Hitachi aimed at improving CX for the elderly.

3. *Shakai Sanka no Susume* App for Smartphone Measurement of Social Participation

Along with appropriate physical exercise and a nutritious diet, active social participation is important for helping elderly people avoid the need to go into care[1]. Here, social participation refers to activities that involve interaction with other people, such as working, participating in local activities, or other community engagement. For many years, Chiba University and the Japan Agency for Gerontological Evaluation Study have been studying the relationship between social participation of the elderly and their risk of going into care. What they have found for older people who are actively involved in such activities is that the future likelihood of their being certified as in need of care is lower by a statistically significant margin[2],[3]. Unfortunately, even though social participation has been demonstrated to be extremely beneficial for reducing the need for care, its importance is not yet widely appreciated by the public. Hitachi believes that if these findings can

successfully be put into practice, it would improve the quality of life (QoL) of the elderly while also addressing the issues associated with caring for them.

For example, while many services exist that can support diet and exercise or quantify activity, there is a lack of mechanisms or services for measuring social participation, reinforcing its importance, and encouraging behavioral change by providing opportunities. Accordingly, Hitachi has been looking into the practical implementation of services with such functions.

In terms of measuring social participation, having a digital means of determining when the subject goes out or spends time on activities outside the home, for example, would at least provide some indication that they are not housebound all the time, with a wider range of places visited corresponding to a higher level of social activity. Ways that this activity measurement could be done include the Global Positioning System (GPS) and the motion sensors and step sensors that are standard features in today's smartphones. As the percentage of smartphone ownership among older people has been rising steadily, Hitachi decided to develop the *Shakai Sanka no Susume* (encouraging social participation) app as the basis of its service.

Users of the app can have information on their daily activities collected automatically simply by carrying around a smartphone that has the app installed. This information includes step count and details of when they leave their home, including the route traveled and places where they spend time. As well as using the information to provide a score on their level of social participation, the app also helps to raise awareness of how to avoid going into care, providing regular news items on past studies by the aforementioned Japan Agency for Gerontological Evaluation Study (see **Figure 1**). The app was launched in June 2022

Figure 1 — User Interface of *Shakai Sanka no Susume* App
By installing the app, users can automatically obtain a record of their daily activities and get a ranking on their level of social activity. The app also provides regular news items about how participation in society can help people avoid going into care.
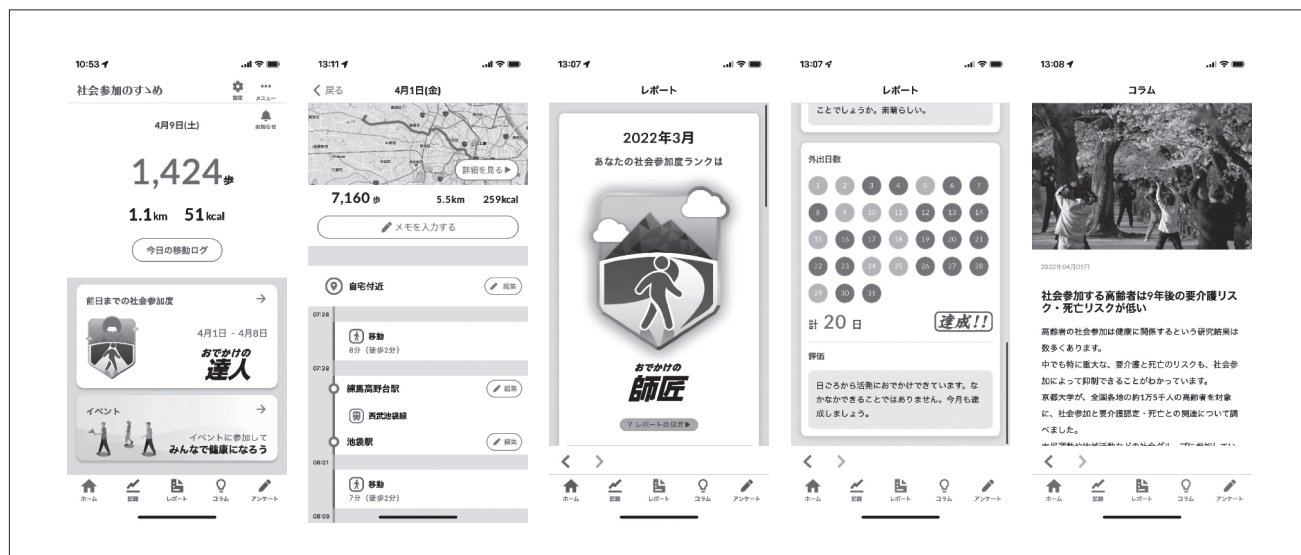
and is available to all as a free download from both App Store*2 and Google Play*3. While the app is currently only a prototype, lacking a full set of features, the intention is to continue updating it as more is learned about user needs.

A goal of this service is to use anonymized data on social participation to assist a variety of industries in their development of products and services targeted at the elderly. The nursing care coverage offered by insurance companies provides a good example. Given the knowledge that active involvement by older people in social participation reduces their future risk of being certified as in need of care, there is potential for services that offer benefits to people who can provide proof of this activity, such as discounted premiums or being able to take out policies on advantageous terms. Furthermore, as it gains more users, the app will become a means of connecting with the active elderly, creating the potential for media functions or for matching users with companies that market to the elderly.

To assess the viability of the business concept, Hitachi is currently working with other companies on trial projects that use data collected by the app. By working with private-sector businesses and identifying CX best practices that will serve as a basis for social participation by the elderly, Hitachi plans to grow the service into one that will provide strong support for companies that are expanding their businesses for the elderly while also helping to extend healthy lifespans.

4. Conclusions

This article has described the work Hitachi has been doing to improve CX for the elderly, having recognized that populations are aging around the world. To devise services that offer strong support for self-sufficiency among the elderly, Hitachi also intends to be an active collaborator with companies and municipalities that share these same ideas.

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*2 App Store is a registered trademark or trademark of Apple Inc. in the USA and other countries.

*3 Google Play is a registered trademark or trademark of Google LLC in the USA and other countries.

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Development of EBPM Business Platform through Co-creation with Local Governments and Startups

Hitachi has started work on building an EBPM business platform as part of the Tokyo Metropolitan Government's Project Support for Creating Next-generation Wellness Solutions for FY2022. The project includes the development of a new EBPM business platform utilizing a Hitachi secure personal data platform and AI analytics for nursing care, health, and medical big data as well as verifying assessments of the outcomes of work by Hachioji and Fuchu cities on preventive care (pre-emptive measures to avoid the need for long-term care). This article describes the core personal data platform and big data AI analytics along with the EBPM business platform, which leverages co-creation with local government and startup businesses.

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Yoshinori Sato

1. Introduction

Given estimates that appropriate preventive care (pre-emptive measures to avoid the need for long-term care) by the government could save an annual JPY3.2 trillion in benefit payments, there is a strong public interest in high-quality preventive services with regard both to improving lifetime quality of life (QoL) and putting finances on a better footing[1]. Moreover, private-sector businesses, too, have a part to play if the government is to achieve the broad-based delivery of services to residents in a way that makes the most of its available resources. Meanwhile, recognizing the benefits of pursuing "wise spending" and the use of private-sector services, government is adopting pay-for-success (PFS) practices, a form of public-private partnership whereby payments are linked to improvements in performance indicators designed to resolve administrative issues[2]. Unfortunately, the inability to assess the cost-benefits of preventive measures is an obstacle to the broader adoption of PFS and is holding back the introduction of private services. The fundamental difficulty with measuring the benefits of preventive measures is that the relevant data is so widely scattered. This includes data on what measures have been used and by whom as well as data on the outcomes of these measures, such as healthcare records and the results of medical checkups or certification for requiring care or support. That is, there is no mechanism in place to consolidate this data for use as evidence to assess program outcomes.

In response, Hitachi is working with local government and startup businesses to develop an evidence-based policy making (EBPM) business platform to underpin PFS-based preventive care programs, undertaking this as part of the Tokyo Metropolitan Government's Project Support for

Figure 1 — Management of Personal Information Using Searchable Encryption

Searchable encryption allows encryption keys and data to be held separately, something that was difficult to achieve using previous search techniques. It randomizes personal information to significantly reduce the risk of information leaks. It allows users search data without decryption and is applicable to a wide rage of works.
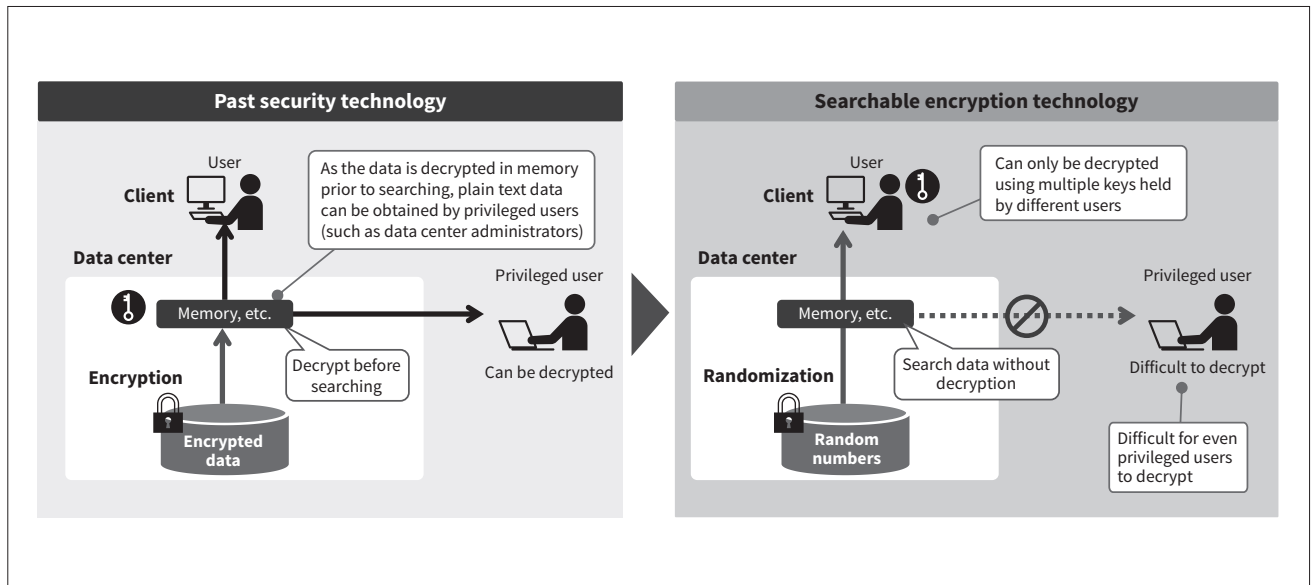
Creating Next-generation Wellness Solutions for FY2022[3]. This article presents a summary of this project and describes its core features, namely a secure personal data platform and the AI analytics applied to nursing care, health, and medical big data.

2. Secure Personal Data Platform

2.1
Tokumei Bank Confidential Information Management Service

Tokumei Bank (anonymous bank) is a cloud service that utilizes a type of secure computing called searchable encryption, meaning it can search information that has been stored in randomized form[4]. Along with reducing the risk of data leaks, the technology also makes it easier to comply with relevant laws and guidelines, with no encryption or decryption keys being held in the cloud (or sent over communication links) (see **Figure 1**). Whereas past practices required data to be decrypted in the server memory before it could be searched, searchable encryption avoids this need for decryption. When used in the management of personal information, a balance is struck between data usefulness and the protection of individual rights and interests by randomizing details such as name or date of birth that could identify an individual and handling other information in the form of pseudonymized data. Also, practical uses tend to involve searching through the data. For this reason, searchable encryption has previously been used in a wide range of secure computing applications, including many instances

where Hitachi has used it to handle sensitive information such as patient records and other healthcare information, resident data, and in Japan's Individual Number (so-called "My Number") system.

2.2
Personal Information Management Platform

The personal information management platform provides infrastructure for sharing information with the consent of the individual concerned and is compatible with the demand that has arisen over recent years for managing information based on the concept of self-sovereign identity (see **Figure 2**)[5]. Information is aggregated and collated on an individualized basis by collecting it from the data holder, subject to consent. Consent for this collated information can be given on an item-by-item basis, with the provision of data to users being governed by these settings. The platform is built on the Tokumei Bank service for managing confidential information, where the details that can identify an individual are randomized and other information is handled in the form of pseudonymized data. This pseudonymized data can be shared with other applications by means of an open application programming interface (API). Limiting access to pseudonymized data ensures a high degree of security in its use.

By collecting and aggregating different forms of information in this way, the personal information management platform maximizes the value of personal information and provides ways of delivering value to both individuals and society by making that information available subject to the consent of the individual concerned.

Figure 2 — Block Diagram of Personal Information Management Platform

By combining functions for the dynamic management of individual consent with the Tokumei Bank service for managing confidential information, the platform provides a mechanism for greater security in the storage and distribution of personal data in the cloud.
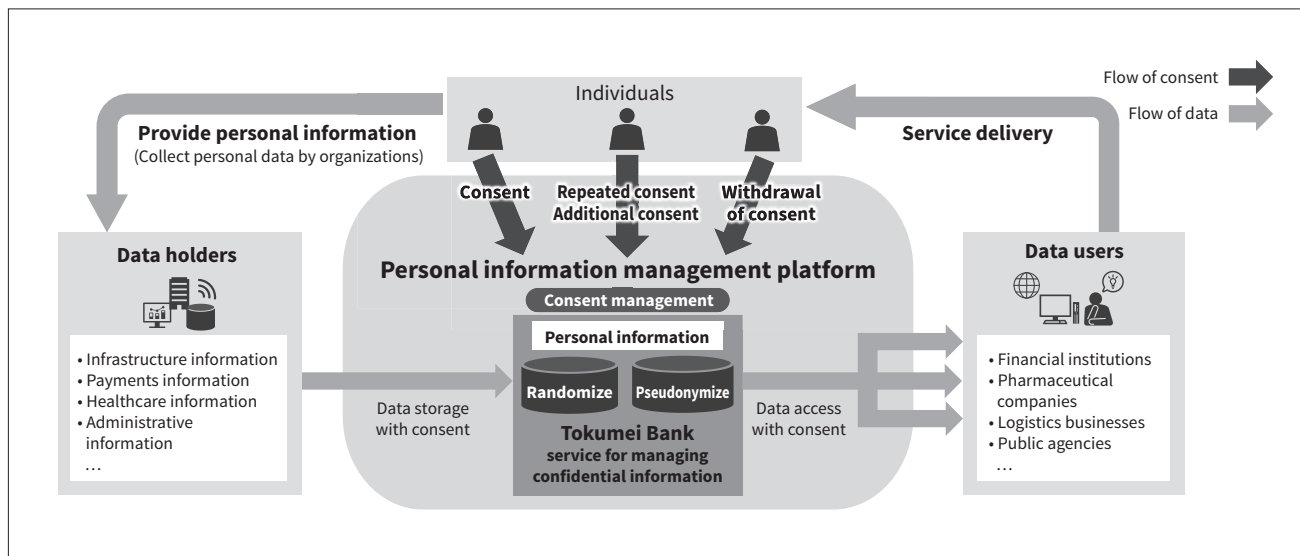
3. AI Analytics for Nursing, Health, and Medical Big Data

3. 1
Local Government-owned PHRs and Other Nursing, Health, and Medical Data

Through its involvement in the healthcare services of medical insurers, including local governments, Hitachi has acquired analytical techniques and expertise in medical data, including health checkup data, treatment data, and nursing care data. It also supplies operational support services that make use of AI. This section explains what data is needed for the collation and analysis of the personal health records

(PHRs) and other medical data held by local governments that forms the basis of this business.

Table 1 lists the PHR and other nursing, health, and medical data held by local governments. Before the preventive and other benefits of PHR or health business support services that use AI can be analyzed, the nursing care, health, and medical data held by local governments and the data held by PHR services first need to be aggregated. This is done by assigning keys that identify the individual concerned in data held by the National Health Insurance Database (Kokuho Database, KDB) and PHR services. In the case of nursing care data, to provide vital data that sheds light on the daily living habits of elderly people, the KDB system has started collecting data such as responses to basic checklists or questionnaires conducted at places where the

**Table 1 — PHR and Other Nursing, Health, and Medical Data Held by Local Government**

Before AI analysis can take place, the nursing, health, and medical big data to be used in the analysis needs to be aggregated first.

Data type	Healthcare records (PHRs)	Basic checklist (administrative data)	Medical billing and clinical data (administrative data)	Certification as in need of care or support (administrative data)
Summary	Daily lifelog data from app, such as exercise and diet	Responses to 25 questions for assessing risk of needing long-term care	User information and health data needed to calculate risk of dementia or need for care, sourced from medical services, etc.	
Examples	• Step counts • Dietary records • Cognitive training performance • Social activity records	• Uses bus or train to go out? • Goes shopping for daily needs? • Any falls in past year?	• Results of regular and special health checks • Health advice data • Medical, dental, and pharmaceutical billing data	• Level of care, cost • State of care (calculation basis)
Collection methods	■ *Shakai Sanka no Susume* (encouraging social participation) app for preventing dementia and need for care Apps from wellness company partners	■ Local government questionnaires Local government	■ KDB system (supplied by National Health Insurance Organizations) Systems KDB (National Health Insurance Database) Local government	

AI: artificial intelligence   PHR: personal health record   KDB: Kokuho Database

Figure 3 — AI-based Health Business Support Service for Tochigi Prefecture

The figure shows how Risk Simulator for Insurance was deployed in Tochigi Prefecture. By enabling efficient business planning and in-depth health advice, Hitachi's analytical techniques and expertise in medical big data are being used to slow the progression of diabetes.
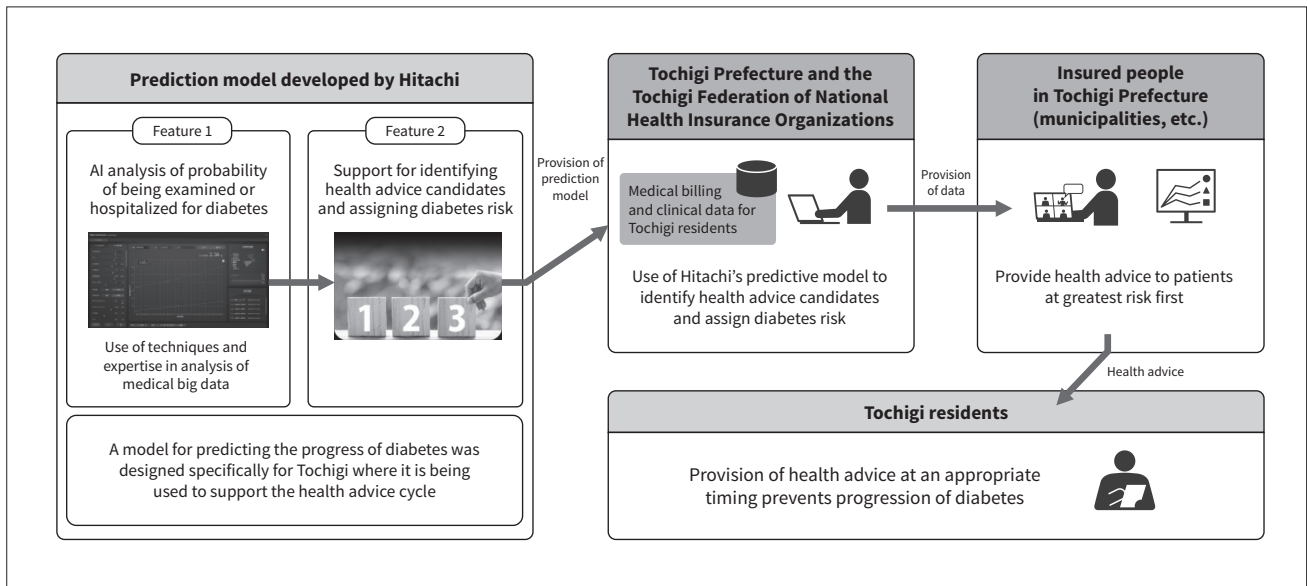
elderly congregate to enable the statistical analysis of big data that covers lifestyle as well as past results of nursing care services.

3. 2
Health Business Support Services that Use AI

One example of a support service that uses AI was launched in Tochigi Prefecture in June 2021 with the goal of slowing the progression of diabetes[6] (see **Figure 3**). Past practice was to manually select who receives health advice from a long list of candidates based on the Tochigi Prefecture Program for Preventing Aggravation of Diabetes, selecting on the basis of factors such as age, gender, and medical history so that advice is provided to as many insured patients at high risk of diabetes as possible given the limited human resources available. With the new service, expertise from the Risk Simulator for Insurance, a Lumada solution for the analysis of medical big data, was used to build a predictive model specifically for predicting the progression of diabetes. It utilized eight years of medical and pharmaceutical billing details and clinical data that had been anonymized to prevent the identification of individuals. By allowing Tochigi Prefecture and the Tochigi Federation of National Health Insurance Organizations to provide a list of health advice candidates that includes their degree of diabetes risk, it is hoped that this will significantly reduce the cost to municipalities. Services for assessing the effectiveness of their healthcare operations have also been provided to other local governments. Along with making health advice more efficient, the use of big data analytics and AI by these services is also helping to address the challenges that healthcare and illness prevention pose to local governments.

4. EBPM Business Platform through Co-creation with Local Governments and Startups

4. 1
Tokyo Metropolitan Government's Project Support for Creating Next-generation Wellness Solutions for FY2022

As part of the Tokyo Metropolitan Government's Project Support for Creating Next-generation Wellness Solutions for FY2022, Hitachi has been working on the development of an EBPM business platform for preventive care that is designed to work with PFS-based programs[3]. The work is based on a Hitachi secure personal data platform and AI analytics for nursing care, health, and medical big data described above. Undertaken in partnership with Hachioji City, Fuchu City, A10 Lab Inc., Rehab for JAPAN, Inc., and Mealthy Inc., this project for putting evidence-based practices in place to help people avoid having to go into long-term care is made up of two separate initiatives.

4. 2
Initiative 1: Development of EBPM Business Platform

Hitachi is working on an EBPM business platform for measuring the benefits of preventive measures in partnership with Hachioji and Fuchu cities, both of which have made a preventive care smartphone app available as a service to residents (see **Figure 4**). This includes the secure cloud-based data matching of PHRs held by wellness companies with KDB data on the outcomes of medical and nursing care in the two municipalities. The business platform is built

Figure 4 — Overview of Business Envisaged as End Goal of this Project

The EBPM business platform uses the Tokumei Bank for the secure management and data matching of KDB and PHR data, and AI to measure the business outcomes. The services provided to local government include support for PFS-based preventive care programs.
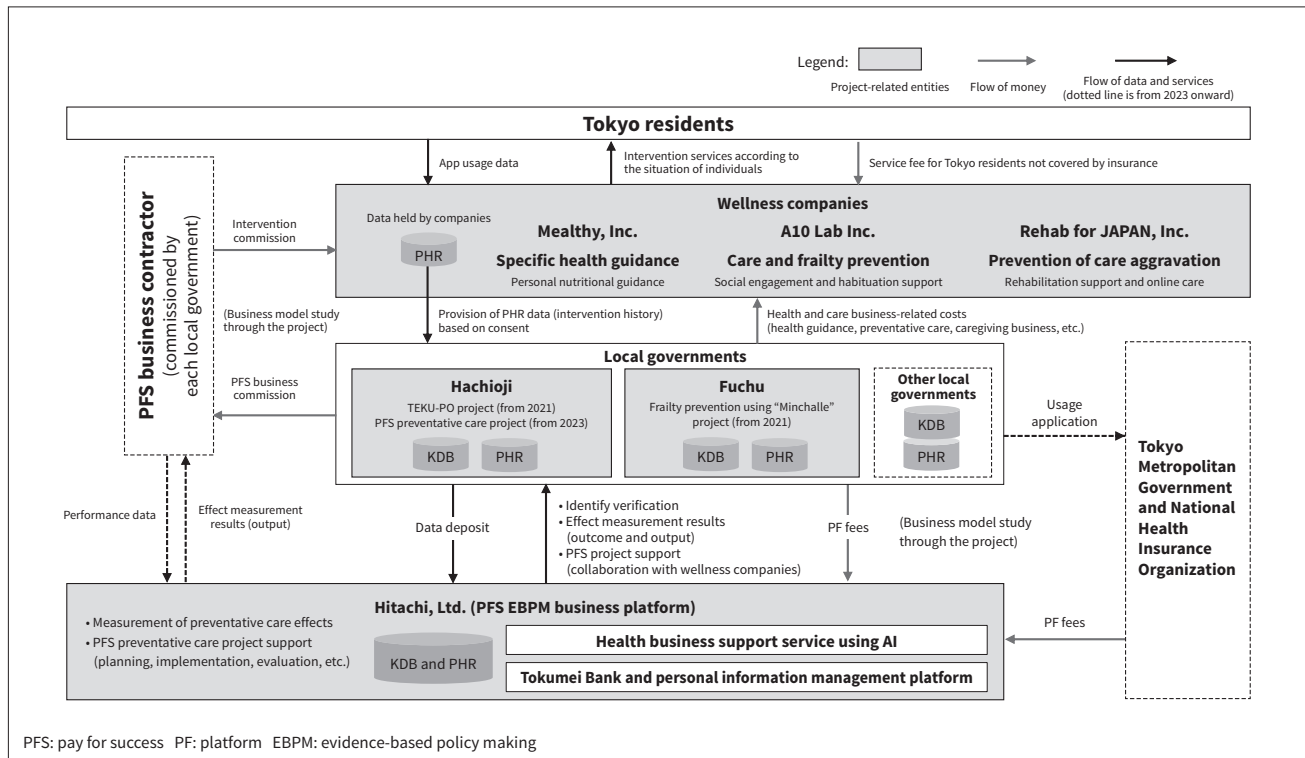
on a platform for personal information management that uses proprietary Hitachi technologies to enable the secure use of personal data. By utilizing AI-based health business support services and techniques for big data analytics, such as explainable AI, the business platform can also calculate outcomes such as the size and associated benefits of care and medical cost savings and reductions in the percentage of people certified as in need of support or care. The goal is to enable the implementation of evidence-based business planning and assessment of the operational performance of local government.

The project has included the trialing of preventive care programs in Hachioji and Fuchu cities along with progress on establishing ways of using data to assess how well different measures work.

4. 3
Initiative 2: Establishment of PFS Preventive Care Program

One use case for evidence-based preventive care involves work on establishing a sustainable preventive care program as a public-private partnership. This draws on efforts to promote commercialization by the Tokyo Metropolitan Government's Project Support for Creating Next-generation Wellness Solutions for FY2021. Undertaken in partnership with Hachioji City, A10 Lab, Rehab for JAPAN, and Mealthy, this study is working toward establishing PFS-based preventive care programs and is looking

at the use of the EBPM business platform to assess their outcomes. In anticipation of widespread use across local governments grappling with preventive care, the goal is to use this work as a basis for establishing a service model that will support PFS-based preventive care programs that operate in partnership with wellness companies.

5. Conclusions

This article has presented the technologies used in the EBPM business platform and described the work done as part of the Tokyo Metropolitan Government's Project Support for Creating Next-generation Wellness Solutions for FY2022. In the future, Hitachi intends to continue its efforts to improve lifetime QoL and control social security costs in an aging society by providing evidence-based measures for preventing the need for long-term care through both the secure use of data and business model innovation.

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Use of MR for Skills Transfer in Healthcare Workplace

Co-creation with Medtronic Japan

As new devices enter medical use, doctors, nurses, and other medical practitioners are continually being called upon to quickly familiarize themselves with new equipment and skills. To facilitate this, Hitachi Solutions, Ltd. offers a service that uses MR technology from Microsoft Corporation. Based on consultations with experts from Medtronic Japan Co., Ltd., a Japanese subsidiary of the world's largest medical device company, it was suggested that this service could be of benefit to theater nurses in operating theaters. Hitachi Solutions has now partnered with Hitachi Solutions Create, Ltd. to develop a training tool called HoloMe that shows where an experienced theater nurse directs their attention while working. This article describes the development of this tool, which became available from Medtronic Japan in March 2022, as well as the technologies used and the benefits anticipated.

Mikiyo Yamaki

1. Introduction

Along with aging demographics and a low birthrate, the challenges facing community healthcare in Japan include increased workloads for doctors, nurses, and other medical practitioners and a shortage of resources relative to the number of patients. Meanwhile, advances in medical technology mean that these doctors and nurses also need to find time amid their busy daily schedules to familiarize themselves with the correct ways of using new devices. In operating theaters in particular, theater nurses, the nurses who assist the surgeon by passing instruments, also work with them to ensure that the surgery proceeds safely and smoothly, visiting the patient prior to surgery, conducting assessments, and making meticulous preparations, including the instruments and whatever else is needed to be ready for whatever situations may arise during an operation. During the surgery itself, they need to be able to anticipate how the operation is proceeding so as to assemble the right instruments and have them ready to pass to the surgeon when needed. Past practice has been to use on-the-job
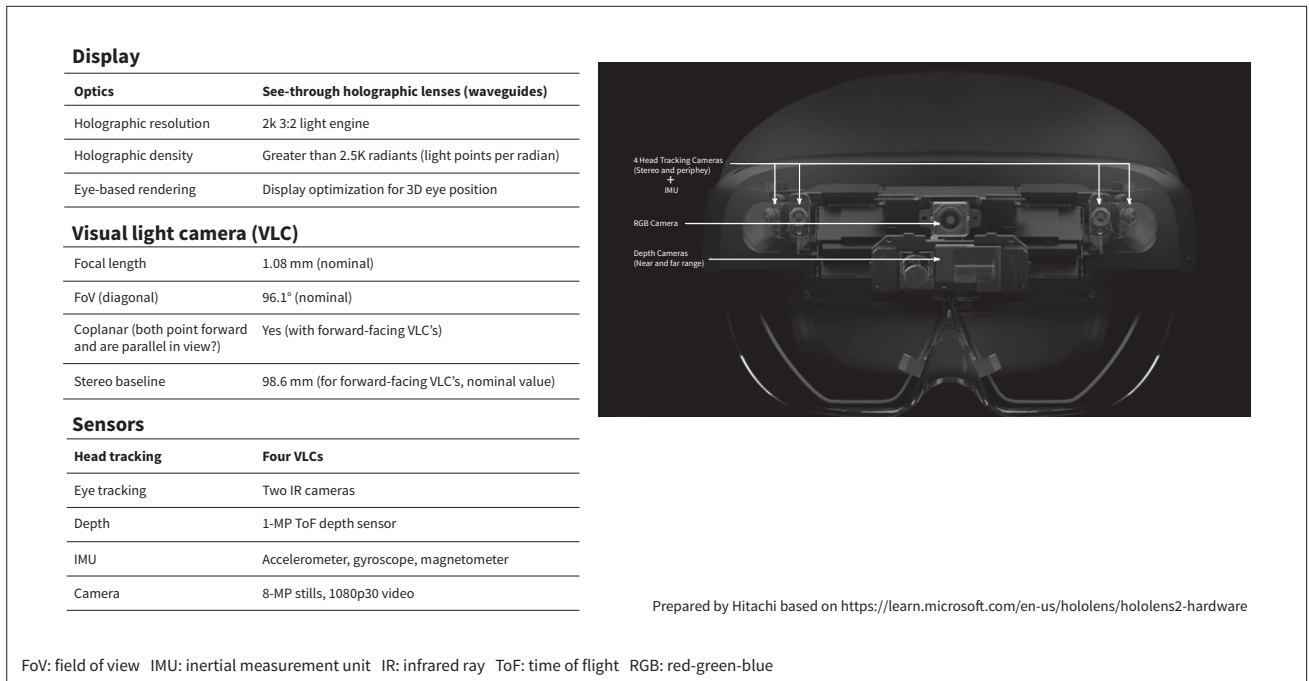
training to upskill inexperienced theater nurses, having a more experienced colleague alongside during operations to supervise and help them acquire the requisite skills. Unfortunately, valuable opportunities for inexperienced nurses to acquire these skills have been lost due to factors such as the COVID-19 pandemic, which has required the number of people present during operations to be kept to an absolute minimum while also taking away many learning opportunities such as participation in intensive training programs at the hospital or off site. This has created a need for more training opportunities for inexperienced theater nurses and new and efficient ways of teaching them how to handle medical devices correctly.

2. Combining Nurse Upskilling with Workload Reduction

The skill gap between experienced and inexperienced theater nurses manifests not only in their proficiency at selecting and arranging medical instruments, but also in their "watchfulness," meaning their ability to anticipate what will come next during the course of a surgical operation. This watchfulness enables a theater nurse to know which

Figure 1 — HoloLens 2 Hardware Specifications

The hardware specifications for the HoloLens 2 are listed below together with a frontal view of its component parts.

Display

Optics	See-through holographic lenses (waveguides)
Holographic resolution	2k 3:2 light engine
Holographic density	Greater than 2.5K radiants (light points per radian)
Eye-based rendering	Display optimization for 3D eye position

Visual light camera (VLC)

Focal length	1.08 mm (nominal)
FoV (diagonal)	96.1° (nominal)
Coplanar (both point forward and are parallel in view?)	Yes (with forward-facing VLC's)
Stereo baseline	98.6 mm (for forward-facing VLC's, nominal value)

Sensors

Head tracking	Four VLCs
Eye tracking	Two IR cameras
Depth	1-MP ToF depth sensor
IMU	Accelerometer, gyroscope, magnetometer
Camera	8-MP stills, 1080p30 video

4 Head Tracking Cameras (Stereo and periphery) + IMU

RGB Camera

Depth Cameras (Near and far range)

Prepared by Hitachi based on https://learn.microsoft.com/en-us/hololens/hololens2-hardware

FoV: field of view   IMU: inertial measurement unit   IR: infrared ray   ToF: time of flight   RGB: red-green-blue

instruments they need to have ready so that they can be handed to the surgeon as needed. Unfortunately, much as inexperienced nurses may wish to acquire this skill of watchfulness, it is hard for them to see where an experienced nurse is directing their attention during an operation. In response, Medtronic Japan Co., Ltd.; Hitachi Solutions, Ltd.; and Hitachi Solutions Create, Ltd. have developed a training tool that uses mixed reality (MR)[*1] to provide a spatial representation of the direction of gaze of an experienced theater nurse who has good knowledge of how to use medical instruments and when to pass them to the surgeon. Inexperienced nurses can then learn these skills by watching them. Used in practice, this can reduce the amount of time experienced nurses spend on supervision and give the inexperienced nurses the ability to train during their spare time, requiring only that they have a suitable device available. This makes it possible to upskill theater nurses while also reducing their workload.

3. Use of MR in Work of Theater Nurses

3. 1
Advances in Hardware and Choice of HoloLens 2

A number of new virtual reality (VR) goggles have come on the market since 2019 when work on developing the MR-based training tool first got underway. Along with their external design, the cost of these goggles has progressively decreased while also featuring lighter weight and enhanced functionality compared to their predecessors. The HoloLens[*2] 2 from Microsoft Corporation comes with the Mixed Reality Toolkit (MRTK) for development and is equipped with infrared cameras in the lenses that track head movement. Using these, it is possible to track where the user is looking and to represent this within the virtual space. While this tracking and display of the user's line of sight has typically required expensive specialist equipment in the past, the arrival of the HoloLens 2 means it can now be achieved for a much lower price. Furthermore, a device like the HoloLens 2, with its contactless operation, is particularly well-suited to medical environments where there are restrictions on which objects can be touched. **Figure 1** lists the specifications of the HoloLens 2 used in this development.

3. 2
Implementation

(1) HoloLens 2 eye tracking function

The HoloLens 2 uses the infrared cameras in its lenses to track the user's line of sight, providing this information as coordinates based on which indicator objects can be projected and visualized in real space (see **Figure 2**).

This function was implemented using MRTK 2.4 and the Unity[*3] development platform. **Figure 3** indicates how the eye tracking function of HoloLens 2 is used to show the user's line of sight.

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*1 A technology for viewing through a device where virtual objects can be displayed against a real-world backdrop just as if they were physically present.

*2 HoloLens is a registered trademark of Microsoft Corporation.

*3 A game engine with a built-in integrated development environment (IDE) that can also be used to create MR, VR, and augmented reality (AR) content. Unity is a registered trademark of Unity Technologies or its affiliates in the U.S. and elsewhere.
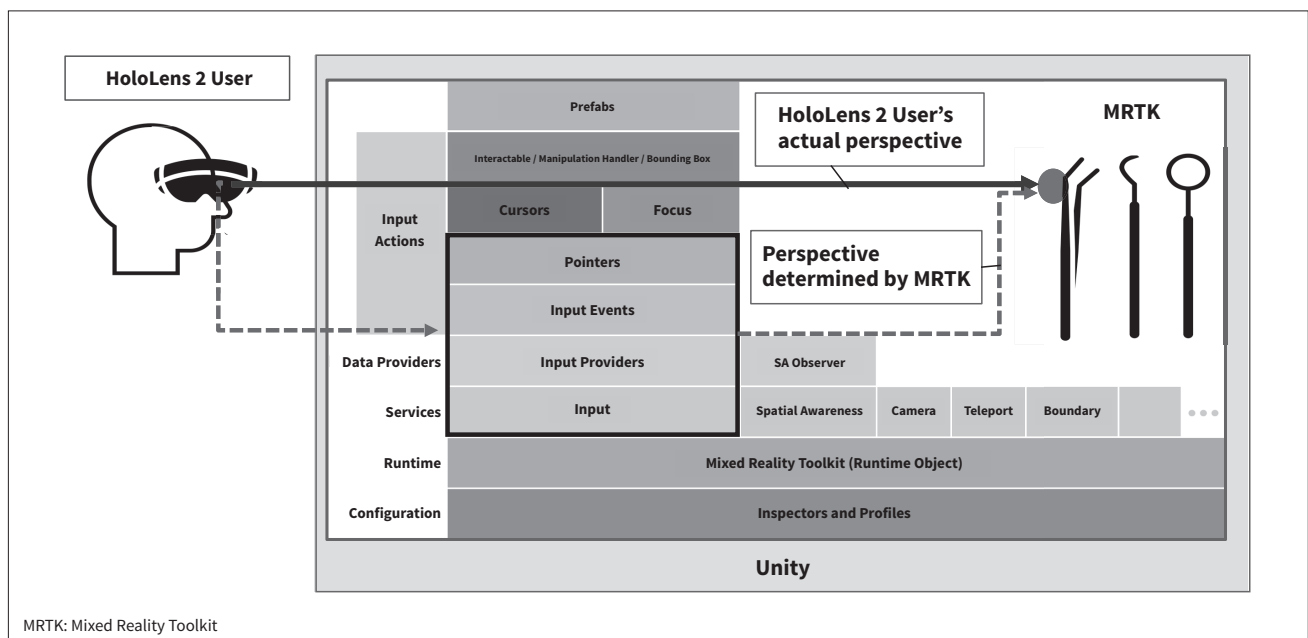
Figure 2 — Use of HoloLens 2 Eye Tracking to Show Sight Line

The indicator object displayed mid-screen next to the medical instruments shows where the user is looking.

Figure 3 — How HoloLens 2 Shows where User is Looking

The IR cameras inside the HoloLens 2 lens are used to determine where the user is looking.

MRTK: Mixed Reality Toolkit

The line-of-sight information presented by this function shows more than just the main direction in which the user is looking, also providing details such as the speed of eye movement, length of gaze, and when they shift their gaze from one point to another. Showing the user's line of sight in this way can be thought of as a form of human enhancement, with technology being used to augment human physical capabilities and senses.

(2) Design of spatial UI

Using the HoloLens 2 to implement the eye tracking feature of this system also required the design of a user interface (UI) that is simple enough for anyone to use. The way the HoloLens 2 is designed to be used involves displaying menus or buttons in virtual space and allowing the user to interact with them by pointing, voice, or line of sight. In other words, it is very different from using a keyboard or mouse. To allow the theater nurses who are the intended users of this system to keep both hands free, it mainly uses

voice commands, with simple menus designed to be easy to read and uncluttered by too much information. Likewise, the optimal display position is chosen so as to not impede the user's field of view. They are also designed to feel much like pressing a real button, featuring visual cues and audio feedback.

Utilizing these features, the HoloMe[*4] training application was successfully equipped with a UI that even first-time users of the HoloLens 2 will find comparatively straightforward. **Figure 4** shows a nurse using a HoloMe menu displayed in virtual space.

(3) Offline use

As healthcare applications need to allow for cases where Wi-Fi[*5] is unavailable due to the potential impact on other medical devices, HoloMe was designed to work offline.

[*4] The name of the Medtronic Japan training tool.

[*5] Wi-Fi is a registered trademark or trademark of the Wi-Fi Alliance in the USA and other countries.

Figure 4 — HoloMe in Action in Medical Practice

The image on the left shows a voice-invoked menu and the right shows a nurse using a HoloLens 2.

Photograph courtesy of Medtronic Japan

3. 3

How Learning from Sight Lines of Experienced Theater Nurses Works in Practice

Use of HoloMe is divided into two steps: STEP-1 and STEP-2. STEP-1 is already implemented. It involves having an experienced nurse wear a HoloLens 2 and record how they go about preparing for a surgical operation, including assembling the instruments that will be needed. The resulting video, which also shows their sight line, can then be viewed on a PC or other device. Trainee nurses can watch this to learn about the steps an experienced nurse goes through to prepare for an operation and where they are directing their attention (see **Figure 5**). Furthermore, a trainee can then undertake the same surgery preparation while themselves wearing a HoloLens 2, recording the steps they take and where they are looking. By replaying their own sight-line video on a PC alongside that of the experienced nurse, they can learn by observing how the two differ over time.

STEP-2 is to be developed at some point in the future. Among the possibilities being considered is to use the virtual space to show the pre-recorded sight line of an experienced nurse (synchronized with the progress of the operation) alongside information about the real-time sight line of the trainee. The aim is to provide trainees with a more visceral and on-the-spot sense of how their own "watchfulness" differs from that of an experienced nurse, including the timing of actions. By taking full advantage of extended reality, it

Figure 5 — STEP-1 Process for Skills Training by Showing Sight Lines of an Experienced Nurse

The figures show how trainees can learn by observing the sight lines of an experienced theater nurse captured along with video of a surgical operation.
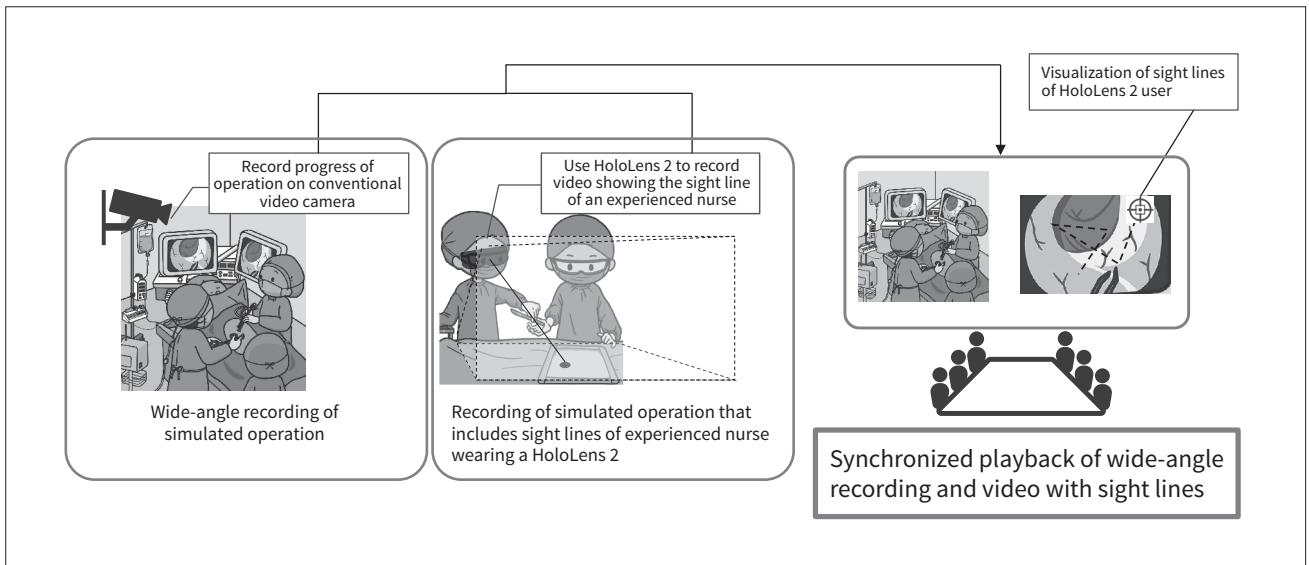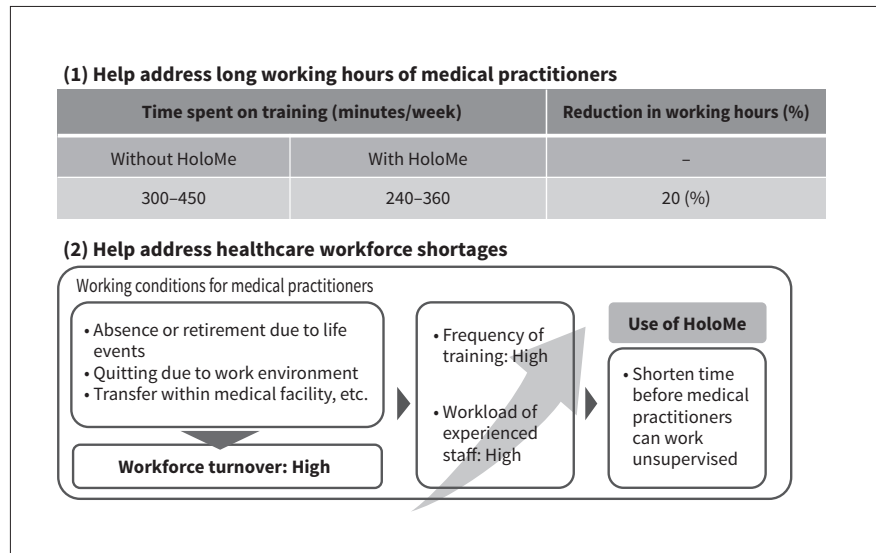
Figure 6 — Expected Benefits of Using HoloMe

It is estimated that use of HoloMe will reduce the time taken for training a medical practitioner by 20% (based on a target of reducing the number of 60-to-90-minute training sessions each week from five to four). It will also help address workforce shortages by shortening the time it takes for medical practitioners to be able to work unsupervised.

(1) Help address long working hours of medical practitioners

Time spent on training (minutes/week)		Reduction in working hours (%)
Without HoloMe	With HoloMe	–
300–450	240–360	20 (%)

(2) Help address healthcare workforce shortages

Working conditions for medical practitioners

- Absence or retirement due to life events
- Quitting due to work environment
- Transfer within medical facility, etc.

Workforce turnover: High

- Frequency of training: High
- Workload of experienced staff: High

Use of HoloMe

- Shorten time before medical practitioners can work unsupervised

should be possible in the future to overcome physical and time constraints, for example by replicating an operating theater anywhere and at any time. It is hoped that MR will continue to deliver new value to the medical workplace in the future.

Figure 6 shows the expected benefits of using this tool. Through the use of HoloMe, Medtronic Japan is targeting a 20% reduction in training times for both experienced and inexperienced nurses. It is anticipated that this will also help address workforce shortages as well as the long working hours of medical practitioners by shortening the time it takes for them to be able to work without supervision.

4. Conclusions

This exercise in collaborative creation (co-creation) with Medtronic Japan has involved the use of MR for medical training. Given the complexity of selecting and organizing medical devices, the vendors of this equipment strive to ensure that it is used correctly and safely. Along with detailed written user manuals, existing practices also include video manuals that can be viewed on a PC. The reason for using MR in this training is that it can explain the use of medical equipment in three dimensions (3D), an entirely new medium. When accompanying Medtronic Japan staff on visits to healthcare workplaces, Hitachi saw instances of medical staff coming in one after another at the end of a long day's work to take turns using the latest equipment for training on suturing techniques. Medtronic Japan staff would likewise help out by bringing along a number of devices to coincide with times when medical staff could make themselves available. Were advances in MR to make possible training that is both realistic and able to overcome the constraints of time and place, it would help to reduce the burden on medical practitioners.

For its part, Hitachi intends to continue developing and supplying technologies that can help to reduce the workloads of healthcare workers.

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Digitalization of Onsite Work for DX in Social Infrastructure Maintenance

The social infrastructure that underpins people's lives needs to operate correctly at all times. Unfortunately, the equipment used in this infrastructure is aging, especially that installed during the high-growth post-war era. Moreover, while most maintenance inspections are conducted by workers onsite, there is a shortage of experienced staff and the workforce, too, is aging. One way to address these challenges is with solution services that use sensors to monitor the condition of social infrastructure and techniques like AI to analyze the collected data. These services can also help to reduce the load on the environment, including through rapid recovery from large natural disasters, enhanced national resilience, and the localization of work. This article presents examples of how Hitachi is working toward the digitalization of social infrastructure maintenance.

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1. Introduction

As much of the social infrastructure that underpins modern life was built during the high-growth post-war era, the rising proportion of aging equipment is a concern. Estimates indicate that the cost of inspecting and repairing this aging infrastructure is likely to exceed annual budgets by 2035. Estimates also indicate that roughly half of all experienced staff are coming up for retirement.

The Basic Plan for Life Extension of Infrastructure of the Ministry of Land, Infrastructure, Transport and Tourism presents an overview of the many infrastructure-related initiatives planned by central government and regional public agencies to address this situation. The plan instructs the agencies who manage this infrastructure to formulate Action Plans for Life Extension of Infrastructure that will enable serious measures to be taken to address this issue around Japan.

By collecting data from edge devices such as radar, cameras, and other sensors, then analyzing it using artificial intelligence (AI) to generate valuable data on the maintenance of social infrastructure, Hitachi is contributing to the digital transformation (DX) of inspection and repair work by the agencies responsible (see **Figure 1**).

2. Overview and Examples of Social Infrastructure Maintenance Work

This section gives an overview of social infrastructure maintenance and describes two of the services provided by Hitachi: a water leakage detection service and a subsurface visualization service. This includes an explanation of how

Figure 1 — Future Directions for Social Infrastructure Challenges and Solutions

As the social infrastructure built during the post-war era of rapid growth is coming toward the end of its life, the industry faces shortages of experienced maintenance staff and the aging of its workforce.

IoT: Internet of Things   AI: artificial intelligence
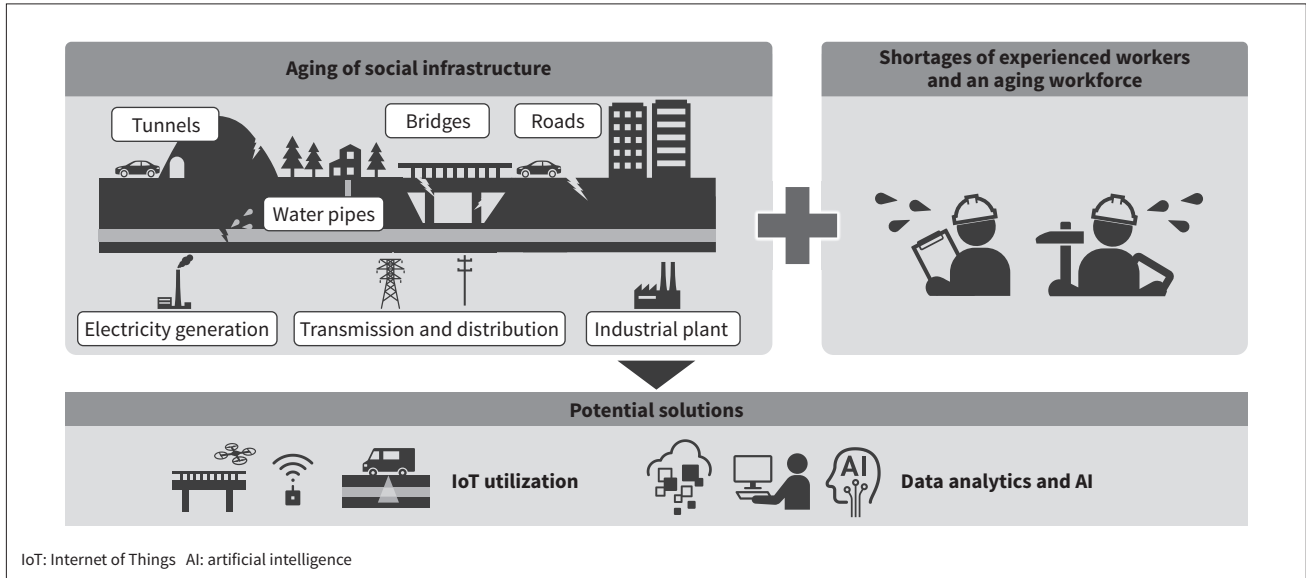
these services facilitate rapid recovery from major natural disasters and the work being done to reduce the load on the environment.

2. 1

Overview of DX in Social Infrastructure

Whether it be above or below ground, Hitachi provides solutions ranging from inspections to the optimization of repair planning for the social infrastructure belonging to a variety of industries (see **Figure 2**). Past practice was to develop systems for specific customers through a bespoke system integration (SI) business. More recently, having recognized commonalities in the challenges facing social infrastructure, Hitachi has begun providing solution services that transcend the boundaries between different customers and industries. By finding the best mix of solution services that focus on this commonality of challenges along with knowledge of customers and industries derived from many years of working together, Hitachi can provide the services they need quickly and at low cost (see **Figure 3**).

Figure 2 — Hitachi Social Infrastructure Maintenance Solutions

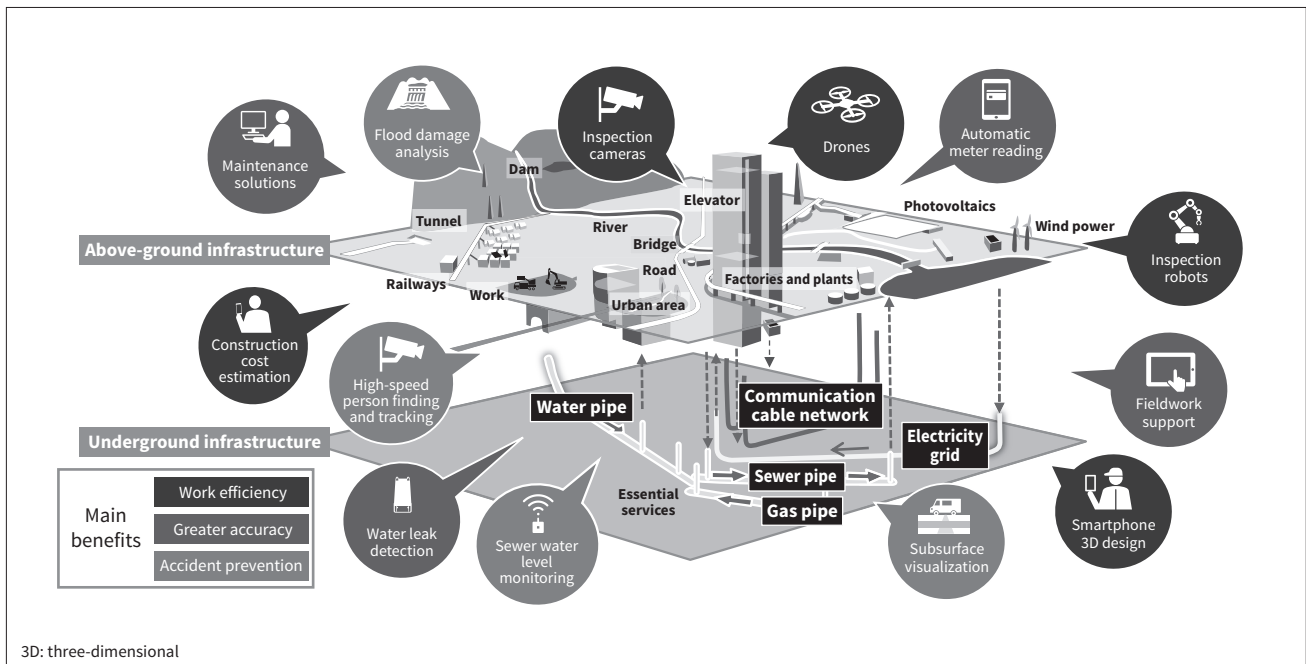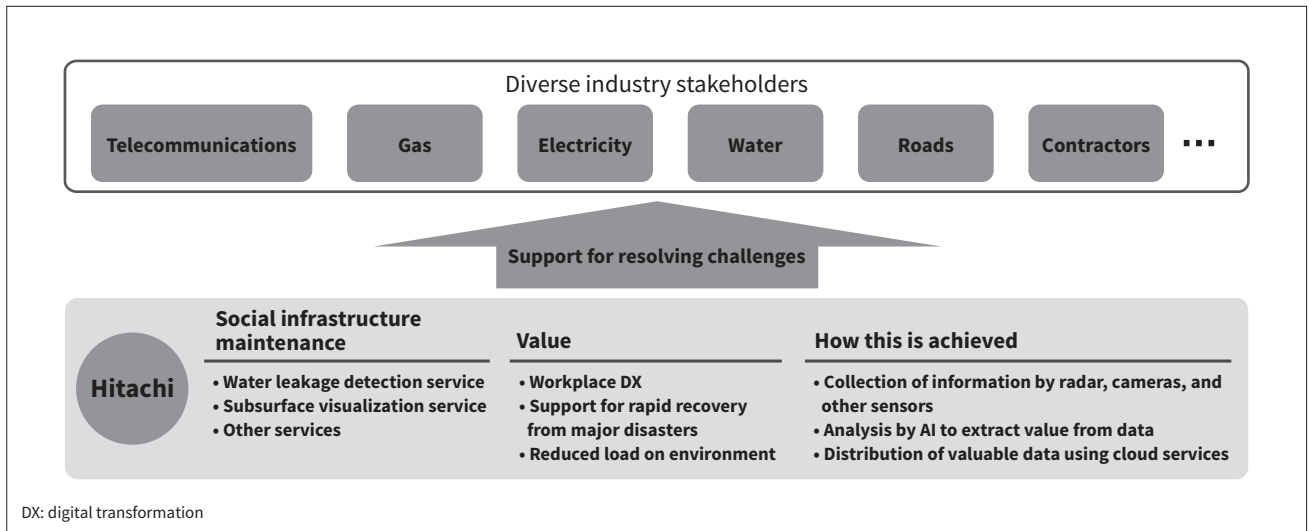Hitachi provides total solutions for a range of social infrastructure.

3D: three-dimensional

Figure 3 — Industry-wide Workplace DX

Workplace DX is being pursued across the industry, involving a wide range of stakeholders.

DX: digital transformation

The goal is to deliver greater value while also equipping existing services to deal with the new risks that are likely to arise as progress is made on workplace DX. To achieve this, Hitachi intends to further expand and deepen its collaborative creation (co-creation) with stakeholders.

2. 2
Water Leakage Detection Service

The water leakage detection service[1], [2] uses ultra-sensitive vibration sensors developed by Hitachi for the continuous monitoring of water pipes. It combines networked leak sensors with a cloud-based monitoring platform (see **Figure 4**).

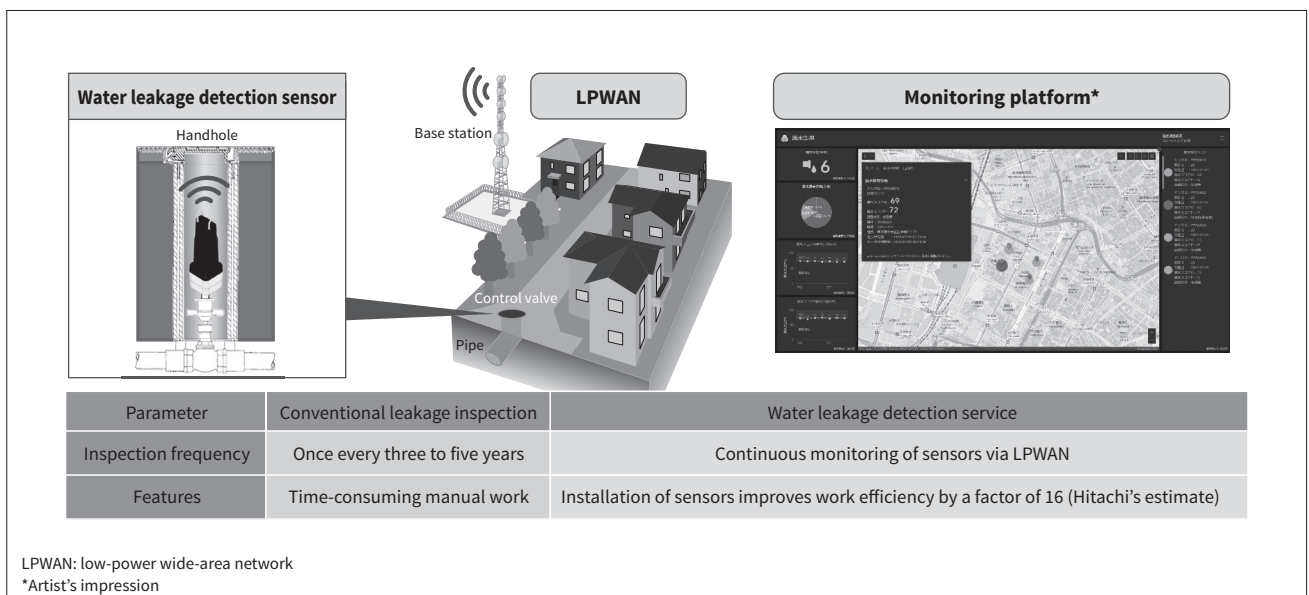The service works through sensors mounted on control valves in the pipe network that measure the vibrations emitted at sites where water is leaking. This data is then analyzed using an algorithm developed by Hitachi to calculate a leak risk score. A low-power, wide-area network (LPWAN) based on Long Term Evolution-machine (LTE-M) communications is used to send the scores to the monitoring platform where a map screen displays whether leaks are suspected and the locations of the sensors that are detecting them.

The service provides remote monitoring of the condition of underground pipes without having to visit the site. By narrowing down the areas where suspected leaks are located, it should also make the task of finding them more efficient.

The service was awarded the Minister of Education, Culture, Sports, Science and Technology Prize at the 51st

Figure 4 — Overview of Water Leakage Detection Service

Hitachi's water leakage detection service achieves high accuracy by using ultra-sensitive vibration sensors and algorithms developed in-house. Problems caused by water leaks can be minimized through continuous monitoring via an LPWAN.

Parameter	Conventional leakage inspection	Water leakage detection service
Inspection frequency	Once every three to five years	Continuous monitoring of sensors via LPWAN
Features	Time-consuming manual work	Installation of sensors improves work efficiency by a factor of 16 (Hitachi's estimate)

LPWAN: low-power wide-area network
*Artist's impression

Japan Industrial Technology Awards organized by Nikkan Kogyo Shimbun, Ltd.[3] It is widely used in Japan, helping to make social infrastructure safe, secure, and resilient.

Municipal utilities are the main customer base for the water leakage detection service and large parts of their pipe networks are now coming due for upgrading, having largely been built during the post-war high-growth era. It is because this work has fallen behind that leaks continue to occur.

Instead, water utilities conduct regular inspection surveys to address the problem of leakage. Onsite inspection is the main method in current use, involving an engineer going out into the field and listening for the distinctive sound of a water leak. Unfortunately, there is a limit to how well this approach can detect changes across wide areas of piping. As detection also relies on experience and know-how, retaining staff with the requisite skills is another challenge.

The primary benefit of the water leakage detection service is that the remote monitoring it provides enables the early detection and repair of water leaks. Combining the service with existing onsite inspection allows leak monitoring practices to be put in place that improve the efficiency of this work.

Investigation is also underway into extending the service to cover pipe network management (upgrade planning), one of the broad-based challenges facing water utilities[4]. That is, the task of upgrading pipe networks can be made more efficient by using data collected for leak detection to inform decisions on how long particular pipes will be able to remain in service and when they will need to be upgraded.

By integrating water leakage detection with other services and data rather than only supplying it on a standalone basis, Hitachi is also aiming to expand the service into something that will help utilities improve their operational efficiency.

2. 3
## Subsurface Visualization Service

Among the issues to be dealt with when laying or upgrading underground piping is the amount of design work required, including collation and coordination of the separately managed drawings held by different utilities. Discrepancies between drawings and the actual situation are also a problem, with the resulting design changes, work delays, and pipe damage being an impediment to the planned and efficient progress of this work.

Developed through co-creation with Oyo Corporation to enable more advanced and efficient maintenance of underground infrastructure, the subsurface visualization service[5] provides information about such infrastructure to the utilities responsible for it (see **Figure 5**). Instead of relying on human expertise, the information is generated by using a vehicle equipped with non-destructive ground-penetrating radar to scan the region of interest and then using AI analytics to present this visually. The information is collected on a central platform from which it can be viewed on a web browser in the form of accurate and intuitive two- and three-dimensional (2D/3D) images that show what is below the surface, including relative positions. Hitachi's goal in making this service available is to transform existing maintenance processes.

The service was launched commercially in May 2021 and access to information on the platform became available in December of that year. As of November 2022, trials and

Figure 5 — Overview of Subsurface Visualization Service
Positional information about piping, voids, and other underground objects that has been converted into visual form by the analysis of ground-penetrating radar images is managed centrally on a platform and made available to customers on demand. Scanning can be done at a speed of 45 km/h using vehicles equipped with radar, a global navigation satellite system (GNSS), an inertial navigation system (INS) to maintain accuracy in locations where GNSS does not work well, and a mobile mapping system (MMS) for collecting 3D data on road surfaces and the surrounding area.

*Hitachi plans to make information about voids and other underground objects available on the subsurface visualization platform in the future.
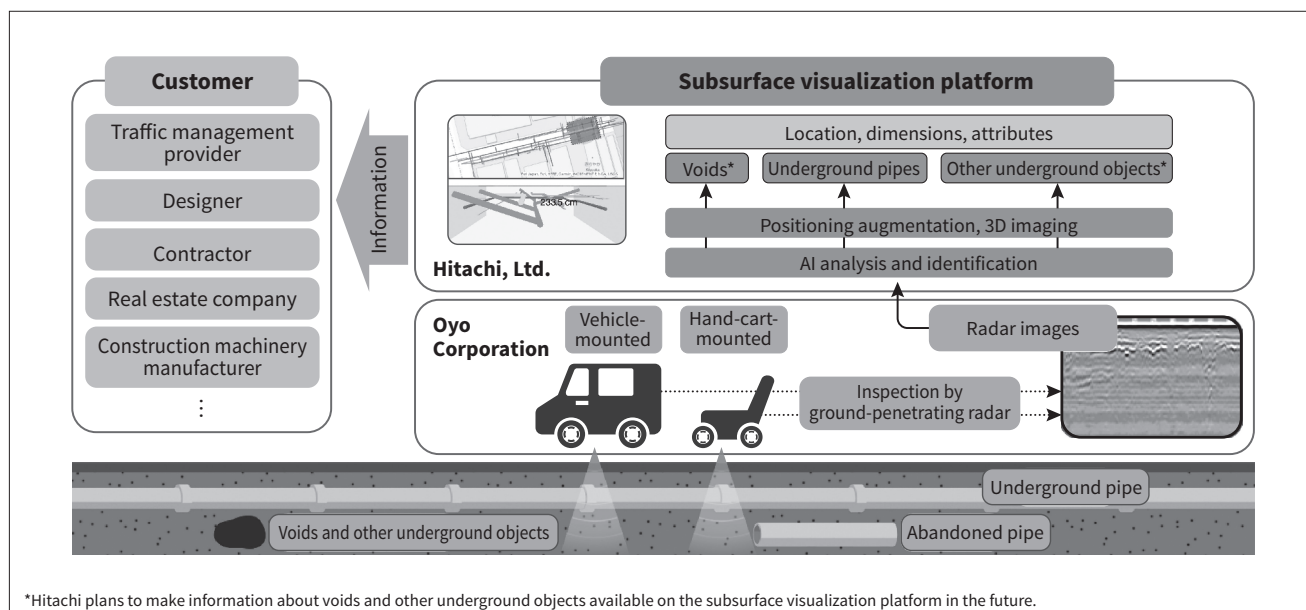
service delivery are underway with 28 organizations (seven gas companies, 13 central or local government agencies, and eight manufacturing companies). When a joint study with Sendai-city Sewer Division (from November 2021 to May 2022) estimated the benefits of using information provided by this service in design work, it found that, by improving the accuracy of design information prior to exploratory digging, it could be expected to deliver a 70% reduction in additional digging or design changes (rework) resulting from discrepancies between drawings and what is underground. A joint study into improving the efficiency of onsite and other work commenced in July 2022. The aim is to utilize knowledge gained in this work to further enhance service functions, establish a service model that is compatible with the needs of local government, and to make the services available to private-sector companies.

Hitachi is also looking at the potential for using the service platform as a place for infrastructure operators to share information, thereby smoothing communications and helping to achieve operational efficiency gains and other advances across the entire industry. The sharing of upgrade plans, for example, currently takes place at venues such as conferences. If simple ways were available to submit and share such information on the platform in a standardized format, and to improve the frequency with which the information is updated, it should be possible to facilitate the sharing of detailed and timely information, reduce the amount of work that utilities put into coordinating with one another and making on-site visits, and lead to greater work efficiencies. By consulting with infrastructure operators about their needs and how best to address them, Hitachi intends to put plans in place and get to work on implementing them.

3. Added Value from Social Infrastructure Maintenance Business

The platforms described above that form part of Hitachi's social infrastructure maintenance business also provide valuable functions in terms of preparedness for major natural disasters. This is in line with the Cabinet Secretariat Fundamental Plan for National Resilience.

For example, large disasters such as earthquakes or landslips can result in leaks from aging water pipes. As many leaks can occur at the same time, in the past it has taken a lot of time and effort to assess the overall situation. In contrast, the continuous monitoring provided by Hitachi's water leakage detection service allows the locations of suspected leaks to be identified while the disaster is happening, thereby facilitating a rapid recovery.

Another example is the undergrounding of power cables as a disaster prevention and mitigation measure. While a lot of work goes into design tasks such as coordinating installation and determining where existing piping is located, Hitachi's subsurface visualization service can help make this work more efficient.

These services also help to lighten the load on the environment. Early detection by the water leakage detection service, for example, prevents the waste of valuable water. Likewise, by reducing the amount of exploratory digging required to make inspections, the benefits of the subsurface visualization service include less waste soil and use of machinery and reduced traffic congestion due to shorter work duration. More broadly, the integrated management on Hitachi's proposed social infrastructure maintenance

Figure 6 — Overall Concept behind Social Infrastructure Maintenance Business
Hitachi is creating an ecosystem for achieving DX in the operations of infrastructure businesses. To be prepared for major disasters, the company is also contributing to national resilience through platforms that remain available during emergencies.
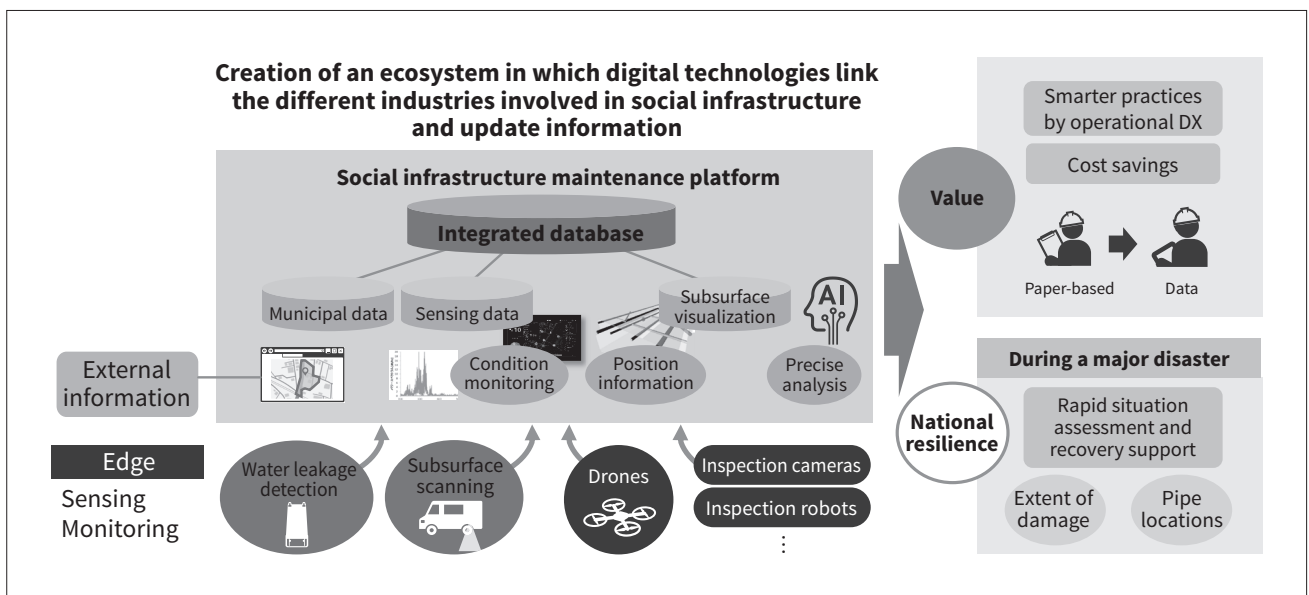
platform of information from many different infrastructure businesses should help to build an ecosystem that transcends the boundaries between organizations, boosting efficiency across all social infrastructure maintenance.

By putting digital technologies such as AI and the Internet of Things (IoT) to work in social infrastructure maintenance so that this work can be conducted appropriately both during routine operations and in times of disaster, Hitachi's goal is to utilize large-scale DX and ecosystem building across many different infrastructure businesses as a solution for strengthening national resilience (see **Figure 6**).

4. Conclusions

This article has presented examples of how Hitachi is working toward the digitalization of social infrastructure maintenance.

In addition to playing its part in digitalization, Hitachi also intends to contribute to the creation of a safe and secure society by developing technologies and services to address the rising concerns of recent years about improving national resilience and reducing the load on the environment.

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Digital Technologies for a Sustainable Future

Hitachi Solutions for Sustainable Societies Combining Design and Digital Technology

Yoshimi Kasai

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