VALUE CREATION

CASE 01 ► LUMADA

OUR INSIGHT AND STRATEGY

Becoming an Innovation Partner for the IoT Era is a key part of Hitachi's 2018 Mid-term Management Plan. The Lumada IoT platform will help Hitachi pursue new value through collaborative creation with customers.

New Value Through Collaborative Creation with Customers

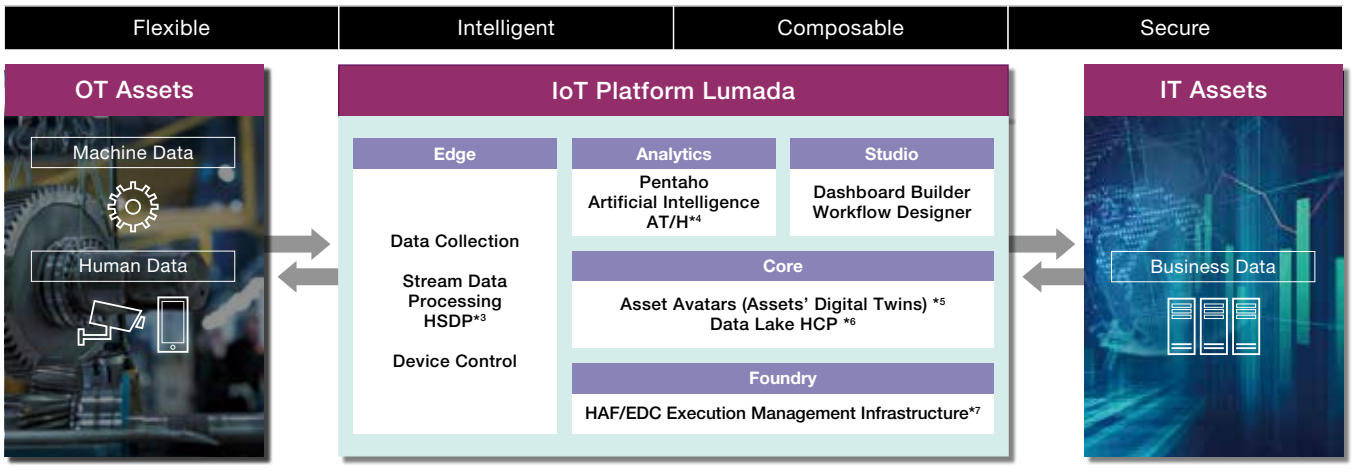
Across the world, from North America to Europe and China, the creation of innovation through digital technology is accelerating. In Japan, too, as part of its "Society 5.0" program,*1 the government has taken the lead in driving a revolution in services and business and transformation of industry structure through digitalization. Amid these rapid changes, in May 2016 Hitachi launched the Lumada*2 IoT platform. Based on the two key ideas of collaborative creation and connections, Lumada is designed to create value through the company's Social Innovation Business by connecting customer value chains and resolving business issues.

Lumada is a distillation of Hitachi's rich and extensive experience in OT (operational technology) and IT solutions, and as such is Flexible, Intelligent, Composable, and Secure. Recognizing that customers usually prefer to make the best possible use of systems that are already deployed and operational, we have prioritized composability as a particular strength: the ability to flexibly combine Lumada with existing systems. Lumada is also easy to link with other IoT platforms and systems, allowing it to support a broad range of industries and customer cases. That Lumada is made up of proven, commercialized, and highly trustworthy technology is another advantage. This technology includes Pentaho, an integrated analysis software package that can bring together diverse data stored in a variety of formats and apply analysis from multiple perspectives, and Hitachi AI Technology/H, a multipurpose AI.

*1 Society 5.0: An umbrella term for several related initiatives designed to create a "Super Smart Society" that will respond to social needs efficiently and meticulously by merging cyberspace and the physical realm at a high level. The term implies a revolution driven by innovations in science and technology creating a successor to the hunter-gatherer, pastoral-agrarian, industrial, and information-based models of society.

*2 Lumada: A name created by combining the words "illuminate" and "data," reflecting the fact that Lumada sheds light on large quantities of data to reveal hidden connections and provide customers with valuable business insights.

The Lumada IoT Platform



*3 HSDP: Hitachi Streaming Data Platform. *4 AT/H: Hitachi AI Technology/H. *5 Digital Twin: The concept of using digital information about a product to build its duplicate (twin) in a visual space. The concept has been proposed by NASA for its next-generation aircraft development. *6 HCP: Hitachi Content Platform.
*7 HAF/EDC: Hitachi Application Framework/Event-Driven Computing.

Lumada Business Growth Model

Hitachi designed Lumada to be the ultimate tool for pursuing new value in collaborative creation with customers, and intends to grow the Lumada business through a combination of three monetization models.

First, Hitachi will provide individual systems to customers through the Lumada SI (Systems Integration) Business. As this business gains experience and knowledge, it will develop new customer cases that can be used to grow the Lumada Core Business, creating "solution cores," blueprints allowing Hitachi to provide leading-edge digital solutions—the second monetization model. Adoption of these ideas internally will also drive improvement in management indicators across the entire Hitachi Group, allowing monetization in a third way.

In the Lumada SI Business, Hitachi develops and delivers data infrastructure customized to meet individual customer requirements. The Lumada Core Business, meanwhile, is a service business in which Hitachi improves management indicators and resolves customer issues by utilizing artificial intelligence to convert customer data into value. Because the Lumada Core Business allows the nimble, global deployment of solution cores created in the Lumada SI business, customer cases can be optimized for more general application in a variety of industries. The Lumada Core Business is expected to expand rapidly. Meanwhile, applying Lumada within the Hitachi Group and its entire value chain will make production sites smarter, reducing manufacturing costs and optimizing inventory management.

Hitachi expects the combination of these three models to help the Lumada business as a whole exceed 1 trillion yen in revenue for fiscal 2018.

Lumada Promotion Framework

The Hitachi Insight Group, an elite team including OT and IT specialists from Hitachi, Ltd., Hitachi Data Systems Corporation, and other Hitachi Group IT businesses, is playing a central role in promoting the Lumada business. Since beginning operations in May 2016 at its headquarters in Santa Clara, California, the Hitachi Insight Group has welcomed hundreds of world-class new hires. Particular emphasis was placed on hiring people with experience in key positions at leading Silicon Valley enterprises.

In April 2017, the research team Insights Laboratory was established. Gathering together researchers, designers, data scientists, and solutions architects from a wide variety of fields, Hitachi is accelerating the pace of innovative collaborative creation by working with customers to develop new ideas, design systems, and demonstrate concepts and value.

Additionally, to promote front-led collaborative creation with customers, in February 2017, Hitachi named a Chief Lumada Officer (CLO), a newly created position, for each business unit. CLOs are responsible for promoting the use of Lumada in such reforms as increasing the efficiency of work processes. The CLOs also share information distilled from the on-site experience of the leading Lumada businesses. Their role is to develop new business models within the Hitachi Group. CLOs will deepen links to the Hitachi Insight Group and promote the expansion of the solutions business and the creation of customer cases within the Hitachi Group.

Lumada Development Case Studies

As of March 2017, Hitachi has collected and published 203 Lumada customer cases, mainly involving the industrial sector, representing successful collaborative creation with customers. We divide the types of value customers typically seek to create into four categories—boosting sales, cost optimization, risk mitigation, and cost visualization—and roughly half of the customer cases published as of fiscal 2016 were for cost visualization (92 of the 203 total cases). Cost visualization is a crucial gateway to the use of Lumada: by letting customers directly experience the value of the platform, it encourages its application in other areas, allowing even greater results to be achieved.

One client of Hitachi Consulting Corporation, a leading beverage maker, had seen its costs mount considerably due to residual odors on some of its products, depending on the quality of water used. The Lumada platform was employed to collect and manage all of the client's water-related information, from intake to drainage, and to clarify water quality maintenance and its costs, enabling Hitachi to offer a proposal on a new filtration system and approaches to managing its facilities.

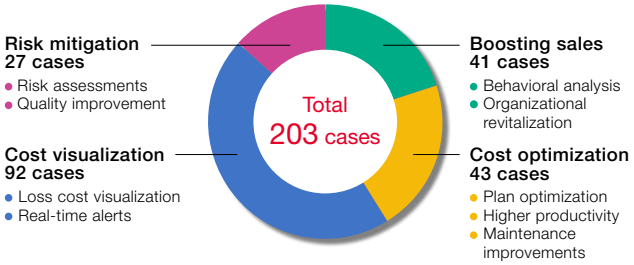
Hitachi used the solutions gained from this customer case in proposals made not only to beverage makers but also to other businesses for which water quality management was an issue. We were able to sign contracts with customers in a variety of industries as a result, including water, food, and papermaking.

Through Front-led collaborative creation with customers, this project contributed to resolving issues that they faced; it also drove the development of new solutions. Hitachi will continue to expand the Lumada Core Business by leading collaborative creation with customers from the Front and capturing new customer cases.

Proactively advancing the use of Lumada within the Hitachi Group has also allowed us to improve our management indicators and therefore our enterprise value. Lumada has proven useful in the realm of cost structure reform, which has long been a focus for Hitachi. Establishing a Lumada workplace dedicated to the Hitachi Group and making full use of analytics and artificial intelligence allows work processes to be visualized and optimized and makes supply chains more efficient from end to end.

As of the end of March 2017, there are 23 Group companies participating in this program, including Hitachi, Ltd., Hitachi Chemical Company, Ltd., and Hitachi Metals, Ltd., demonstrating the value of using actual data from production sites.

Customer Cases (As of the end of March 2017)



Typical Customer Cases

Boosting sales	Optimize promotions based on customer attributes and behavioral history	**Number of customers increased by more than 10%**
		Adopted by companies including a professional baseball team
	Analyze employee work activities and reflect in improvement measures	**Order rate improved by 27%**
		Adopted by call centers and financial institutions
Cost optimization	Predictive failure diagnostic service for large-scale air compressors	**Operational efficiency improved by 20%**
		Monitoring of 250 domestic and 20 overseas facilities
	Predictive failure diagnostic service for medical equipment (superconductive MRI)	**Downtime reduced by 16%**
		Introduced by about 90% of customers purchasing superconductive MRI
Risk mitigation	Analyze the operating condition of manufacturing equipment to detect signs of product defects	**Spoilage expenses reduced by 75%**
		Adopted by electrical equipment manufacturers

Giving Birth to New Value with Our Customers

Keiji Kojima
Senior Vice President and Executive Officer
CEO of Services & Platforms Business Unit
Hitachi, Ltd.

Collaborative Creation with Customers Drives True Competitiveness Overseas

Since unveiling Lumada in May 2016 at the largest IoT event in North America, Informa's Internet of Things World, we have received a great deal of valuable feedback on Hitachi's strategy in discussions with customers around the world.

My impression is that customers outside Japan in particular admire our concept of collaborative creation with customers, calling it "highly unique." Because Lumada is based on Hitachi's long experience in the SI industry, constant and careful attention to customer needs is fundamental to the business. Our goal is not simply to spread an IoT platform—we want to use Lumada alongside customers to resolve their issues. In my view, our customers' understanding that this is our starting position is the reason so many of them have high expectations for Lumada.

In the IoT society, what customers seek is not products but the resolution of business issues. Hitachi is aiming to pivot to a results-based business model, and Lumada is central to that.

Hitachi's Position in the Rapidly Growing IoT Market

Hitachi's extensive product catalog and long experience with IT solutions puts it in an advantageous position within the IoT market. We are intimately familiar with a wide range of products and equipment, from production facilities and railroads to construction machinery. Our Group is also rich in knowledge and experience regarding the evolutionary stages of OT, such as operational controls for trains. IT-only vendors do not have these strengths.

As long as there are products and equipment in the world, enterprises will grapple with issues like how to manage their assets more efficiently and how to reduce the costs of management. This means that Lumada will be able to contribute to a rapidly expanding range of markets. It is not restricted to the bounds of any particular industry. At the same time, carefully selecting markets where bigger results can be achieved more quickly will be crucial to helping the Lumada business grow.

World-Class Human Capital Reforming Organizations and Markets

Santa Clara, California, where the Hitachi Insight Group is based, is now home to many accomplished Silicon Valley veterans—people who play a leading role in the world of IT. In the US, this sort of talent is known as "rock star" human capital.

Most of these "rock stars," it seems to me, share our feeling that the IoT solutions offered by pure IT vendors are limited by a lack of knowledge of products and equipment. The Hitachi Insight Group is where they can fully exercise their creativity to make new breakthroughs.

And their dynamism is astounding. As soon as they join the company, they crisscross the world, visiting production sites in Japan or holding in-person discussions with key figures for their work. New ideas and proposals come in a constant stream.

What we wanted from these new members of our organization was speed and the kind of culture and environment that makes speed possible. The work environments they create and the way they do their work has a big impact on existing employees. The power they have to change both organizations and markets is palpable.

The Next Challenge: Worldwide Expansion

Going forward, I believe that Lumada's challenge will be to strengthen its service delivery globally. Within Japan, the Group's services division is well developed, and Hitachi's ability to provide complete, end-to-end solutions, including ongoing maintenance, is highly valued by customers. We aim to strengthen our delivery channels to allow us to deliver the same level of service elsewhere in the world. Once this framework is in place for Lumada, we expect the rapid expansion witnessed in Japan to be repeated on a global scale.

OUR ACHIEVEMENTS

Omika Works, Hitachi, Ltd.

The wide-ranging development of Hitachi's Lumada Core Business, in which accumulated customer cases and internal deployment studies are offered as solutions to customers facing similar issues, is vital for expansion of the Lumada business as a whole. The high-efficiency production model established at Hitachi's Omika Works is one example of this cycle. Having dramatically reduced production lead times through IoT technology, this model is now attracting significant attention among Lumada's solution cores.

High-Efficiency Production Through IoT

Omika Works has supplied systems for social infrastructure like power generation, railways, and water supply for half a century. High reliability is a must for social infrastructure, and Omika Works is unique in addressing customer requirements with exacting care at every stage of the process, from development of hardware and software to maintenance and service. Omika Works is a high-mix, low-volume manufacturer, meaning that its products are custom-made for each individual client.

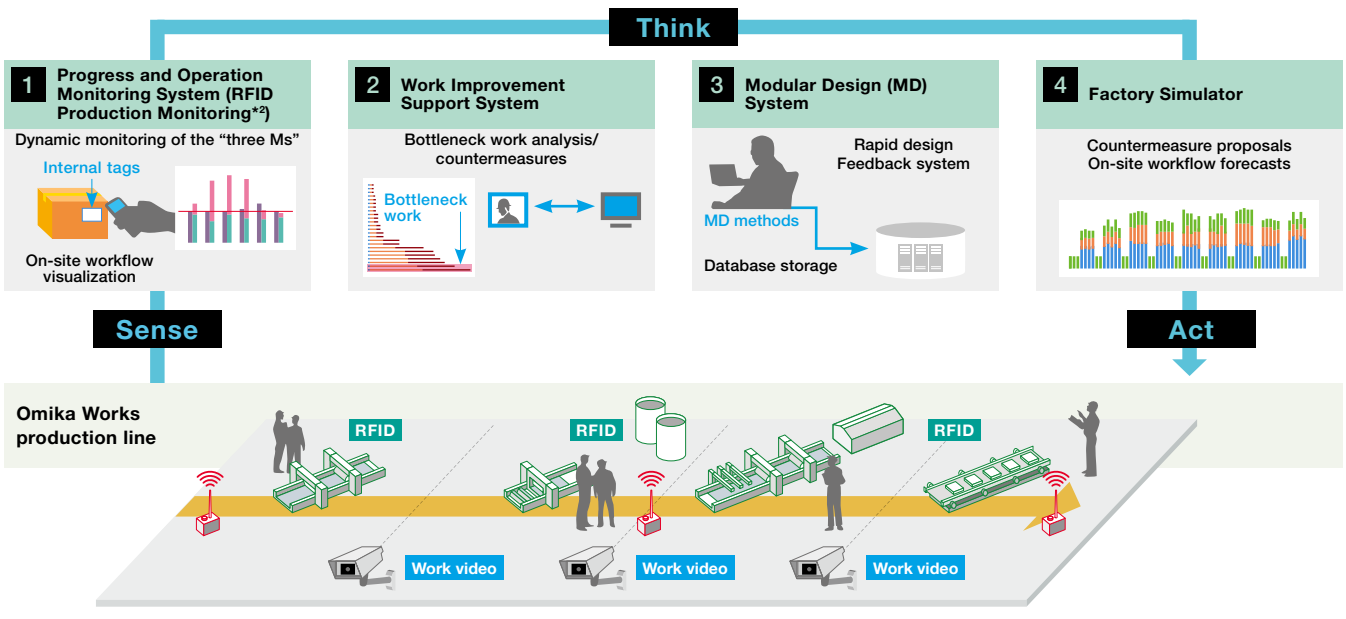
The common wisdom around mass-production factories is that, with standardized product specifications and manufacturing procedures, efficiency can be increased relatively easily through automation. At a plant like Omika Works, however, specifications differ by order, specifications and delivery dates are subject to frequent change, and production tends to rely on a greater proportion of highly skilled workers. For factories like this, improving efficiency through optimization and automation of manufacturing processes is generally held to be difficult.

Nevertheless, as part of the Hitachi Smart Transformation Project, which has been reforming Group cost structures since 2011, Omika Works has embraced the challenge of revolutionizing design and manufacturing by using IoT technology to the best possible effect. To eliminate wasted effort and advance optimization of production planning through visualization of the entire production process, Omika Works not only transitioned to a high-efficiency production model linking four separate systems—the Progress and Operation Monitoring System, the Work Improvement Support System, the Modular Design System, and the Factory Simulator—it also implemented a "Sense, Think, Act" cycle for information about the "three Ms": man, machine, and material. Together, these measures reduced production lead time for representative products*1 by 50%.

*1 These representative products are control devices for power and social industry sectors, accounting for roughly 20% of total production at Omika Works.

Progress and Operation Monitoring System	Performs unified analysis and visualization of production progress and equipment operations to allocate production resources optimally and promote timely improvements when delivery delays are expected
Work Improvement Support System	Facilitates work improvement and shortens the work improvement cycle by automatically extracting processes where actual and expected work times differ and displaying work videos and instructions
Modular Design System	Standardizes shared portions of existing individual product designs as modules, reducing the number of parts that must be designed individually and shortening design lead time
Factory Simulator	Responds to production plan updates such as changes to order quantities or delivery dates by automatically preparing a feasible optimized production plan and adjusting part procurement details

Omika Works High-Efficiency Production Model



*2 RFID: Radio Frequency Identification. A noncontact, automatic detection technology that reads information via radio waves from media such as tags and cards containing IC chips and small antennas.

Accumulated Operational Technology Generates Results

In order to enjoy the benefits of these IT systems to the utmost, hands-on manufacturing knowledge is vital.

Manufacturing involves a chain of connected systems, from order acceptance through engineering (design), procurement, production, quality assurance, and maintenance. Instead of attempting to improve each system individually, adopting the optimal approach for the entire process is crucial. Omika Works' OT allows it to precisely understand the interdependencies between these systems and know how to appropriately address challenges arising in the "three M" areas. Established using OT accumulated over many years, this new production model can now be developed for inclusion among the solution cores Hitachi provides to the manufacturing industry.

Hitachi's IoT: From Omika to the World

To bring the results achieved using IoT at Omika Works within reach of a broad range of customers pursuing improvements in their business, in July 2017, versions of the Progress and Monitoring Operation System and Work Improvement Support System were made available as Lumada solution cores for the manufacturing field, generalized to ensure applicability to a wider range of production facilities. Many customers have already joined our training program introducing the Omika Works IoT implementation case study, and manufacturing reform through collaborative creation with Hitachi is spreading, particularly among high-mix, low-volume manufacturers.

In May 2017, the machine tool manufacturer Okuma Corporation embarked on a collaborative creation project aiming to build on the results achieved at Omika Works and establish an advanced production model that supports mass customization.*1 An experimental model was set up at Okuma's new Dream Site 2 factory. Machine tools are a classic example of a high-mix, low-volume manufactured product, created by processing and assembling thousands or even tens of thousands of components according to diverse customer specifications. Recognizing this opportunity, Hitachi and Okuma will continue working on new generations of factory technology through integration of their manufacturing know-how and collaborative creation on the themes "visualization of production" and "a faster factory control cycle."*2

In recent years, the manufacturing industry has seen customer needs diversify due to the rapid development of digital technology. Increasingly, manufacturers are calling for production systems that can respond to these diverse needs quickly and increasing productivity by making the best use of the "three M" resources on hand has become a challenge. Through collaborative creation with customers, Hitachi will continue to identify management challenges and provide customers with solutions that enable them to digitize the supply chain and production activity from an end-to-end perspective and to improve management indicators.

*1 Mass customization: Realizing mass-production levels of productivity even in high-mix, low-volume manufacturing.
*2 Faster factory control cycle: Deploying a process control system that uses identification tags to grasp the production process more accurately, enabling both reliable identification of bottlenecks and swift remedies.