May 2024 Technical Information

Industrial Digital Solutions

Connective Industries

#Carbon Neutral #Supply Chain Transformation #Innovation Creation #Co-creation and Open Innovation #Productivity Improvement #Generative AI #Digital twins/Simulation #Robotics #IoT/Data Utilization #Industry & Distribution Solutions

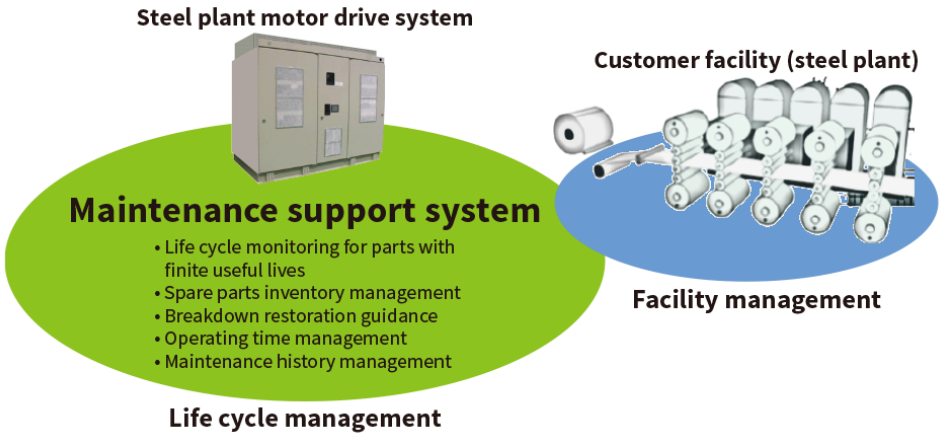
1. Maintenance Support System for Steel Plant Motor Drive Systems

Through a quarter-century of technological advances, Hitachi's steel plant motor drive systems have achieved high functionality, miniaturization, and retrofitting capabilities, and the company is now transitioning to a new stage in this development to further contribute to its customers' facility management (FM).

The newly developed maintenance support system for motor drive systems features functions focused on equipment life cycle management (LCM), a basic pillar of FM. Specifically, this maintenance support system monitors the life cycles of components that have finite useful lives through a combination of time-based management (TBM) and condition-based management (CBM) based on operational data. It can also be linked with spare parts inventory management functions, providing comprehensive support for motor drive system maintenance. In the event of technical trouble, it can also handle breakdown maintenance (BDM), featuring the capability to support restoration procedures through dialogue-style support. The adoption of this maintenance support system will support customers' LCM in terms of both preventive maintenance and corrective maintenance.

Hitachi plans to further develop its motor drive systems, incorporating customer perspectives.

［01］Maintenance support system for steel plant motor drive systems



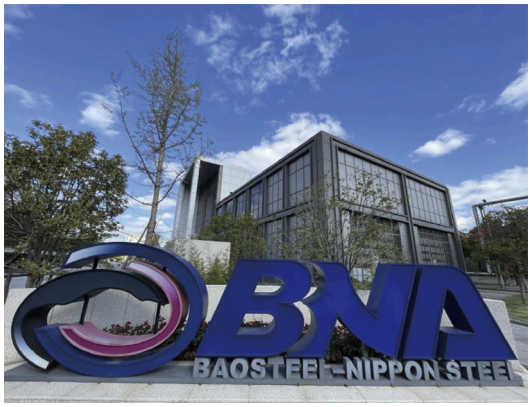
2. Completion of Phase-1 of China BNA's Smart Factory Project

China's BAOSTEEL-NIPPON STEEL AUTOMOTIVE STEEL SHEETS CO., LTD. (China BNA) is engaged in the BNA Smart Factory Project, aimed at coordinating operational data between different equipment and achieving smart operation across six sets of equipment, including coupled pickling line and tandem cold rolling mills and continuous galvanizing lines (CGLs). China BNA has completed the installation and commenced operation of Phase-1 of the project, with systems centered on a real-time remote monitoring system and operational support system (HITSODAS).

The revamping of electrical components has been completed and production has commenced at the No.1 CGL and No.2 CGL.

The implementation of HITSODAS for all equipment in the plant will enable China BNA to collect, visualize, and automatically analyze data on production processes and product quality for each set of equipment and achieve even more sophisticated and stable operations by coordinating and sharing this data between equipment.

［02］BNA Smart Factory Intelligent Control Center



3. Quality Improvement CPS Service

In recent years, Japan's manufacturing industry has been engaged in the digitalization of data collection through digital transformation (DX). However, it is struggling to utilize the data collected due to a shortage of human resources capable of analyzing it across a broad range of different manufacturing processes.

To address this issue, Hitachi has developed a cyber-physical system (CPS) that automatically analyzes data across different processes. This facilitates the utilization of the data by on-site workers, who do not have the time to analyze the data themselves. This service provides the following capabilities, drawing on Hitachi's accumulated data analysis expertise:

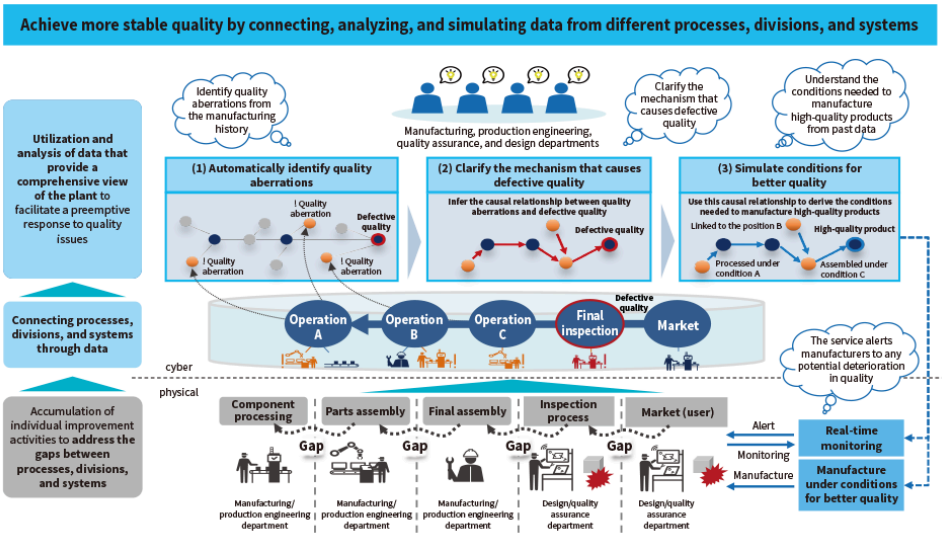
(1) Automatic identification of data that is statistically determined to indicate signs of abnormality or deviates significantly from the designated values as indicative of quality aberrations.

(2) Examination of data items that have a strong causal relationship with quality aberrations and clarification of the mechanism that causes defective quality.

(3) Simulation of new quality conditions by adjusting the values of data items with a strong causal relationship.

These capabilities free on-site workers from the time-consuming labor of data analysis, enabling them to concentrate on utilizing the data to maximize key performance indicators (KPIs) for manufacturing, such as productivity and quality improvement.

［03］Process overview of the quality improvement CPS service



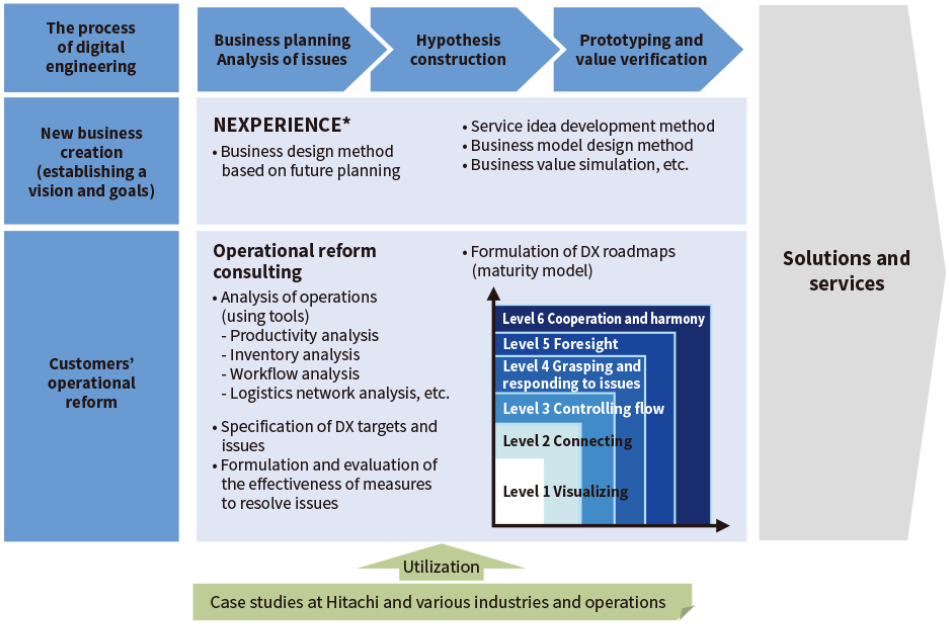
4. Digital Engineering to Achieve DX

The operation of manufacturing and logistics sites requires the construction of value chains that can handle rapid changes in the business environment. Moreover, with the future expected to bring increasingly severe labor shortages due to the decline in the working-age population and the aging of the population, operators will need to formalize the work that was previously tacit knowledge dependent on individuals and implement DX to effectively utilize data.

Several issues hamper the promotion of DX, such as the difficulty in formulating policies amid uncertainty over the future, applying these policies in specific measures, and considering ways to utilize data to achieve these measures. It is necessary to consider these issues after first clarifying the views of senior management and on-site workers and quantifying the current situation and targets.

Hitachi has domain knowledge spanning various fields and operations including manufacturing, distribution, pharmaceutical and medical equipment manufacturing. Hitachi's engineers practice digital engineering by formulating a DX vision based on their understanding of the applicable solutions and quantifying the current situation and targets based on methods such as workflow analysis and inventory/logistics analysis. They then go on to consider specific and realistic measures for system introduction and formulate implementation plans and roadmaps.

［04］The process of digital engineering



* This represents Hitachi's systematic conceptualization of the co-creation methodology used to create new businesses and services through collaboration with partners.

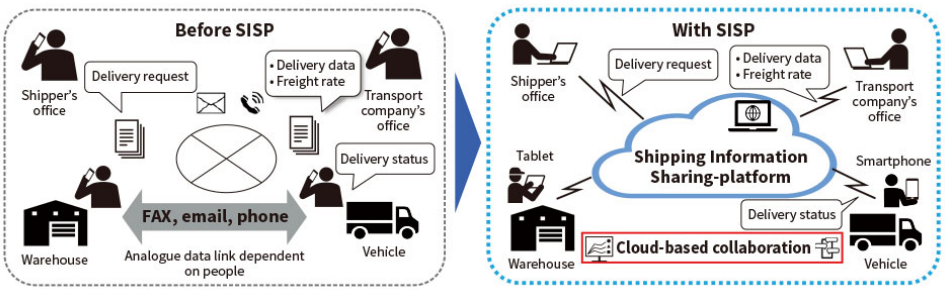
5. Shipping Information Sharing-platform

The logistics industry faces a host of problems that may not only lead to soaring transport costs, but also the risk of transportation capacity shortage. These problems include the implementation of regulations limiting the maximum working hours of truck drivers, commonly referred to as the "year 2024 problem," in addition to a chronic shortage of drivers. These issues urgently demand a solution.

The Shipping Information Sharing-platform (SISP) is a data platform that seamlessly links transport information of the supply chain from collection to delivery. It bridges the gap between different companies to support transport and delivery operations, from the input of transportation request data with cargo amount to vehicle dispatch planning, smartphone-based vehicle moving state management, and result data gathering. SISP facilitates instantaneous information sharing by building networks using the distribution channel information and logistics information held separately by the shipper and transport company. This enables information collaboration including shared shipments, data digitalization, and the disclosure of delivery status.

The use of SISP helps to resolve logistics issues through digitalization aimed at boosting the efficiency of transport operations and reducing administrative work. This includes reducing the number of vehicles by joint deliveries for several shippers, day-trip operation of long-distance transportation through cross-docking, and greater load efficiency through flexible cargo allocations between transport companies.

［05］Illustration of the use of SISP



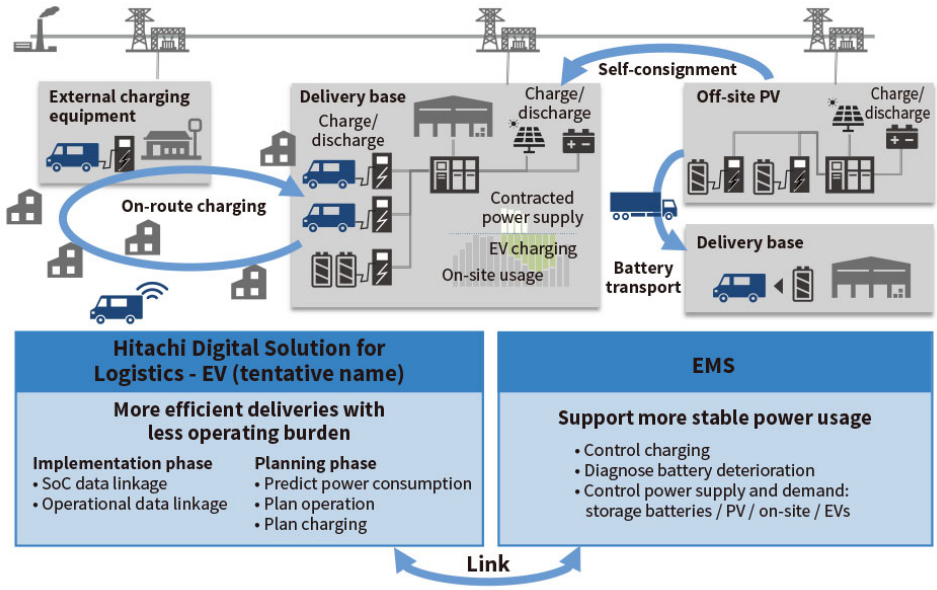
6. Service Development and Outlook for EV Charging and Delivery Solutions for Carbon Neutrality

The logistics industry is facing pressure to transition to electric vehicles (EVs) to achieve carbon neutrality. However, this transition is hampered by the short range of EVs, the need to deploy charging infrastructure, and the need to respond to the associated rise in electrical power consumption. The challenge is to manage charging to avoid running out of power during deliveries, with a consciousness of the charging infrastructure and electricity contracts.

To address this issue, Hitachi is developing Hitachi Digital Solution for Logistics - EV (HDSL-EV; tentative name), a one-stop solution for the overall optimization of operating routes and charging plans. This solution predicts power consumption at the planning phase, taking into account characteristics such as the delivery area and the cargo handled. It then uses this prediction to provide plans that achieve greater efficiency and reduce operating burden, while also rigorously conforming with operational requirements. During the implementation phase, it supports swift and flexible plan modifications through real-time status monitoring. In this way, the solution promotes decarbonization by supporting the stable operation of EVs.

Looking ahead, Hitachi aims to link this solution with energy management systems (EMS) to achieve more stable and economical electric power usage by coordinating supply and demand, including the charging and discharging of EVs, and effectively utilizing renewable energy.

［06］Conceptual illustration of HDSL-EV and EMS linkage



PV: photovoltaic
SoC: state of charge

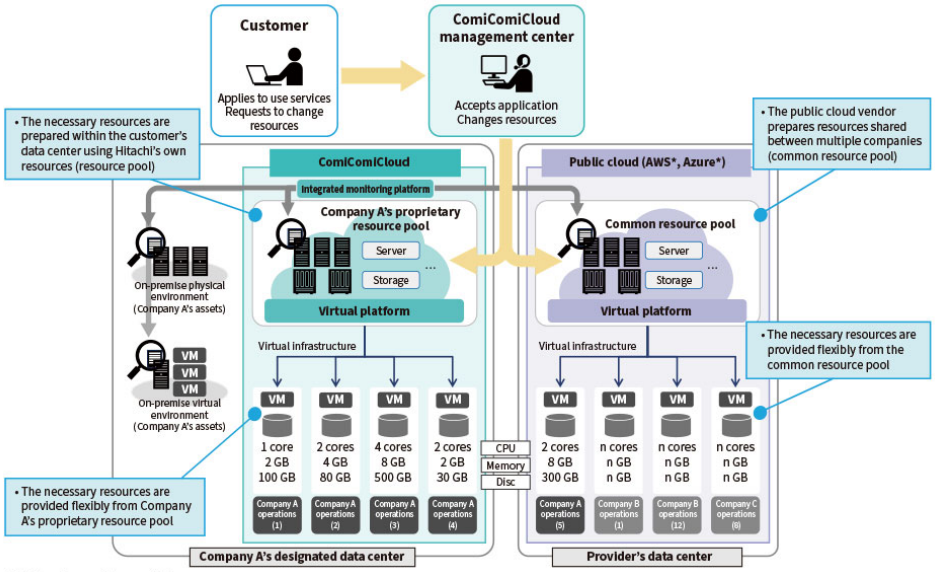
7. Expanding the Managed Service for ComiComiCloud (Pay-by-volume Private Cloud Service)

There is growing demand for hybrid cloud services that optimize the utilization of both cloud-based and on-premise data management to achieve the safe and secure utilization of all forms of data. However, these services are plagued by issues such as the wide range of IT infrastructure required, which complicates operational management and inflates costs. This has led to the need for integrated management of multiple facets of the IT infrastructure.

In this context, Hitachi has launched hybrid cloud management services, which enhance support for both public cloud-based and on-premise data management for its ComiComiCloud managed service. Launched in 2013, ComiComiCloud is a pay-by-volume private cloud service with zero monthly charges that provides transition, management, and maintenance services. Its standard service has the capability to satisfy infrastructure maintenance and management requirements. Customers are also able to customize the service menu based on their own needs.

The new hybrid cloud management services support customers' hybrid cloud-based management by expanding the managed service already provided to handle both on-premises and public cloud-based data management, for both existing and newly implemented systems. Because they achieve the integrated management of IT infrastructure across the whole organization, these services contribute to reducing the burden of complex operational management work, enabling customers to concentrate on core operations such as promoting DX.

［07］Illustration of the adoption of hybrid cloud-based management services in a hybrid environment



VM: virtual machine
CPU: central processing unit

*See the list of “Trademarks.”

8. Development and Case Study of FactRiSM for the Chemicals Industry and Initiatives for Future SCM Optimization

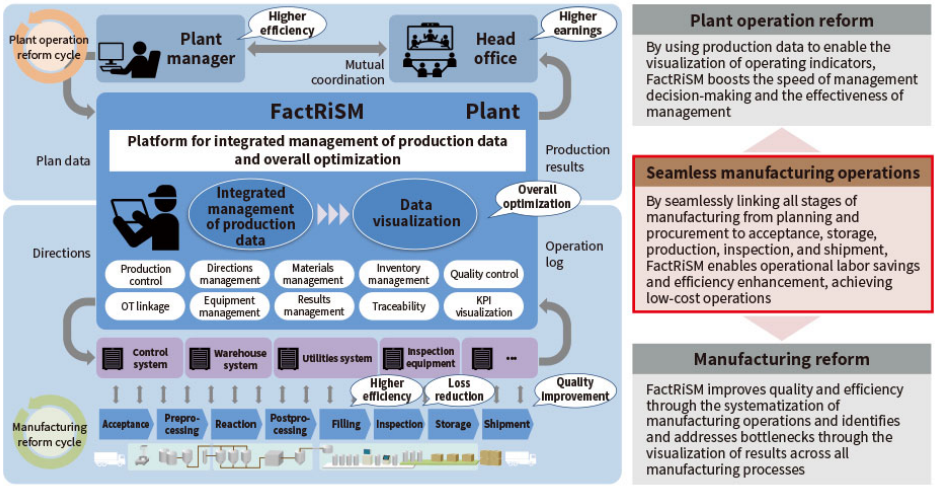
The maintenance and accumulation of on-site know-how has become an urgent challenge for the manufacturing industry due to the decline in the working-age population. Likewise, in the chemicals industry, the demand has arisen for seamless data linkage and utilization between IT and operational technology (OT) to improve the working style of on-site employees and swiftly provide the value-added materials sought by customers. To achieve this, it is necessary to manage historical data and standardize/improve on-site work with even more attention to detail and accuracy.

FactRiSM manages data in association with the human, machine, material, and method (4Ms). It is able to issue standard operating procedures (SOP) for equipment and personnel, record SOP manufacturing data and inspection work, link data with OLE for Process Control (OPC*) and PI AF*, and ensure traceability. Based on this data, FactRiSM enables the visualization of changes in KPIs such as overall equipment effectiveness (OEE), quality, etc. for each product and process and supports speedier initiatives for the overall optimization of operational management.

Looking ahead, FactRiSM will continue to develop as a next manufacturing execution system (NEXT-MES) platform that supports new manufacturing in the chemicals industry. By utilizing artificial intelligence (AI), it will further strengthen its operational, decision-making, and data analytics support, and contribute to manufacturing that can swiftly provide added value to customers.

* See the list of “Trademarks.”

［08］The positioning of FactRiSM



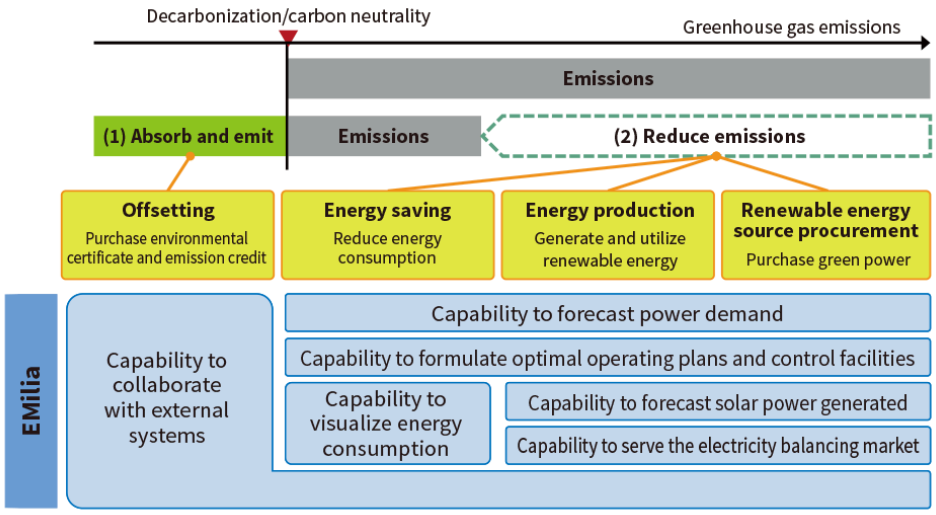
9. EMilia—Integrated Management Service for Energy and Equipment

The figure outlines four initiatives to achieve carbon neutrality. These are: “Energy saving” to reduce the consumption of energy, “Energy production” to generate and utilize carbon-free renewable energy in-house, “Renewable energy source procurement” to obtain green energy, and “Offsetting” the carbon emitted using measures such as the purchase of environmental certificates.

EMilia—integrated management service for energy and equipment—assists in achieving “Energy saving” and “Energy production” by using memory-based reasoning (MBR) to forecast power demand, formulating optimal operating plans based on a consideration of equipment usage restrictions and performance characteristics, and implementing equipment control. It also boosts “Renewable energy procurement” by providing functions for the balancing market to support the calculation of deliverable adjustment capability and the correction of divergence from targets. Used in collaboration with external systems, it can also facilitate “Offsetting.”

Through EMilia, Hitachi will address the various issues facing its customers due to the changing business environment and support business resilience and sustainable growth.

［09］Initiatives to achieve carbon neutrality and the capabilities provided by EMilia



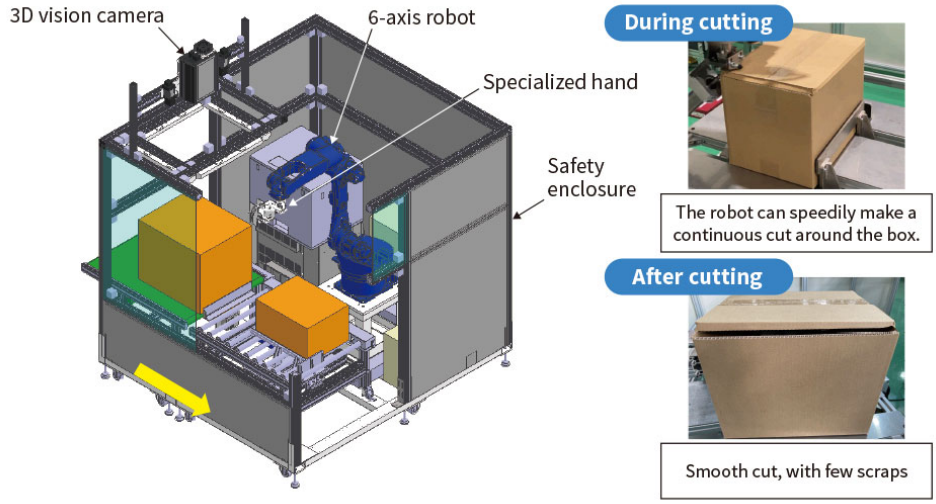
10. Box-top Cutting Robot Utilizing 3D Vision

The logistics industry is handling an increasing variety and quantity of products due to the expansion of personal demand associated with the growth of the electronic commerce (EC) market. At the same time, it faces an increasingly manifest labor shortage due to factors such as the decline in the working age population and shorter working hours due to work style reforms. Freeing tasks from dependence on human operators has become an urgent issue for the logistics industry. To address this issue, Hitachi is promoting automation and labor savings through logistics system integration (SI).

Its newly developed robotic system automates the task of opening corrugated cardboard packaging. Many logistics sites rely on human operators to open packaging, but this simple, repetitive task exposes operators to the risk of knife cuts. The robotic system uses the core technologies of three-dimensional (3D) vision and image processing to replace human operators, accurately measuring the size of cardboard boxes and using a specialized cutter to open top lid. The system incorporates measures to reduce cardboard scraps and dust and avoid any damage to the products inside.

Hitachi will continue to contribute to further automation and labor savings through robotics SI to address the social issue of labor shortages.

［10］Configuration of the box-top cutting robot (illustration)



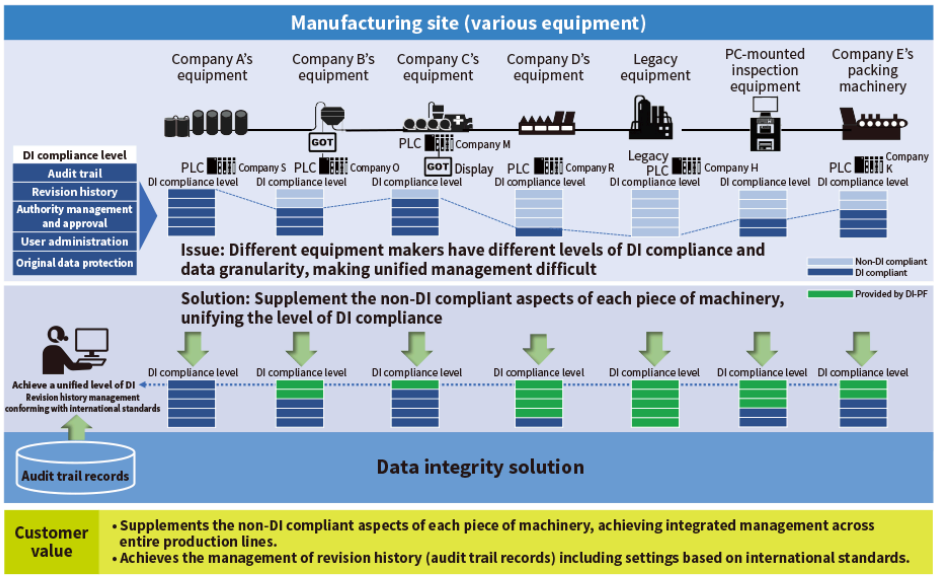
11. Data Integrity Solution

Data integrity refers to the rules on handling electronic records concerning pharmaceutical manufacturing. These rules are embodied in international guidelines such as the United States Food and Drug Administration (FDA) Code of Federal Regulations (CFR) Title 21, Part 11. Manufacturing records include a record of operations referred to as an audit trail, in addition to the measurements reported by various sensors in the manufacturing plant. In recent years, audit trail records have become required even for manufacturing equipment composed solely of programmable logic controllers (PLCs) and touch panels. However, such equipment is not built to retain records.

Hitachi's data integrity solution addresses this issue. As a platform featuring unfalsifiable audit trail databases conforming to international guidelines, management features such as data storage, viewing, reviewing by administrators, and report output, and the capability to collect audit trail data as standard features, it enables users to record audit trails with only minimal equipment modification. The platform can support everything from a single piece of equipment to a production line that is a collection of multiple pieces of equipment. Pharmaceutical manufacturing lines, especially, tend to have several pieces of equipment supplied by different equipment makers, each responsible for different steps in the manufacturing process. Even if each equipment maker complies with data integrity, some variation in granularity is common. By connecting with each piece of equipment, Hitachi's data integrity solution achieves data integrity that integrates whole production lines.

(Hitachi Industry & Control Solutions, Ltd.)

［11］Data integrity solution



DI: data integrity
GOT: graphic operation terminal (touch panel for displaying PLC operations)

12. Video Analytics Service to Boost Customers' Operational Efficiency

Hitachi has leveraged the video analytics technologies it has developed from constructing large-scale video security surveillance systems for train stations, airports, and other facilities to build a cloud-based video analytics platform. Using this platform, Hitachi has established video analytics as a service (VAaaS) to provide a large number of users with standardized video analytics capabilities to address various challenges in each industry and operation. The initial roll-out of VAaaS has seen the launch of materials counting service for construction sites.

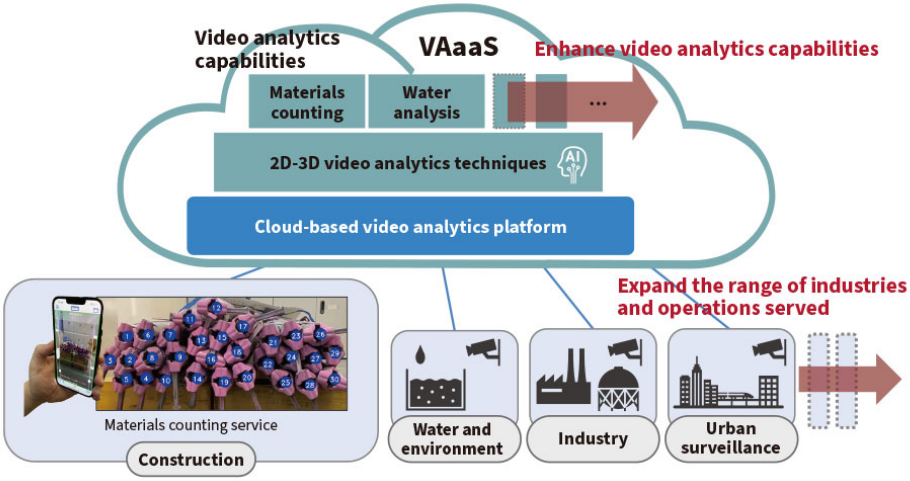
This service enables swift and high-precision cloud-based counting of temporary materials at construction sites, captured on a smart device, through a new video content analytics method using two-dimensional (2D) camera images and 3D point cloud data. This reduces by half* the time required to check the quantity of materials and also enables multiple personnel at other locations to confirm or correct.

Looking ahead, materials counting service will support industry-wide DX by facilitating the confirmation of work traceability and expediting materials acceptance procedures at leasing and construction companies. Hitachi will continue to enhance its video analytics capabilities and expand its services targeting a broad range of fields such as water and environment, industry, and urban surveillance.

(Hitachi Industry & Control Solutions, Ltd.)

* Based on empirical results obtained by Hitachi Industry & Control Solutions, Ltd.

[12] VAaaS cloud-based video analytics service



13. Hitachi's AUTOSAR Solution, Supporting Software Development for Automotive ECUs in the CASE Era

This era, characterized as connected, autonomous, shared and service, and electric (CASE), has seen the emergence of increasingly sophisticated autonomous driving and electrification technologies for automobiles. For on-board systems, recent years have brought an increase in scale and complexity, with the inclusion of 100 or more electronic control units (ECUs) in each vehicle. In this context, the automotive industry faces a significant challenge in controlling development costs and reducing development lead time.

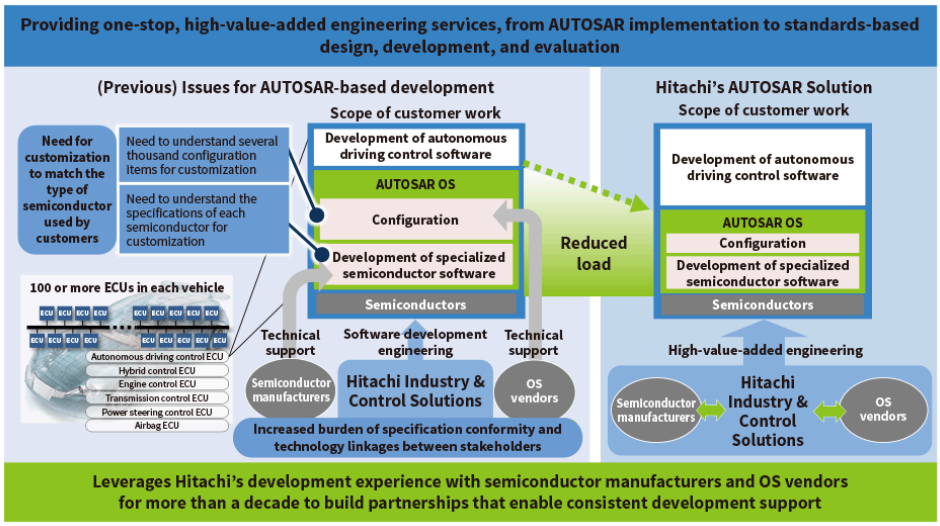
Automotive Open System Architecture (AUTOSAR)* is one initiative aimed at overcoming this challenge. AUTOSAR is the name of a group of standardized on-board software and standard system architecture. The application of AUTOSAR is expected to enhance software reusability. However, until now, AUTOSAR-based development has required the understanding of a massive number of standard specifications. Moreover, it was necessary to achieve specification compatibility and technology linkage between stakeholders to customize products to match the type of semiconductors used by customers. As a result, customers were burdened with increasing costs to train specialist engineers, as well as communication costs.

Hitachi's AUTOSAR solution has been leveraging its AUTOSAR knowledge and experience in joint development with semiconductor manufacturers and operating system (OS) vendors for more than a decade, as well as its partnerships with market-leading companies, to provide one-stop, high-value-added engineering services for technical support and software development, supporting customers when they implement AUTOSAR, with consideration for aspects such as functional safety and cybersecurity.

(Hitachi Industry & Control Solutions, Ltd.)

* See the list of "Trademarks."

［13］Hitachi's AUTOSAR solution utilizing partnerships



14. 3 Ways Automation, Palletize/Depalletize/Mixed SKU, Can Impact Your Warehouse

Logistics and warehousing saw a significant increase in automation after the COVID-19 pandemic hit in 2020. As more consumers were ordering online, automation became more prevalent to help streamline processes and take over repetitive tasks. Recognizing this problem, JR Automation increased automation offerings to help customers meet demands including:

(1) Widget packaging process where end-of-line packaging utilizes automation to help with product placement into boxes, sealing boxes, container inspection, adding labels. Automating this process will help with efficiency and throughput, and offset labor shortages.

(2) Automated palletizing, depalletizing and mixed stock keeping unit (SKU) systems that efficiently automate manual and time-intensive tasks within manufacturing to increase production time.

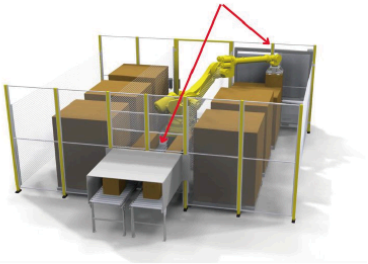
(3) Value-add engineering and build-to-print services to provide replication of machines/process and a collaborative approach to enhance original design specifications.

Going forward, the company will continue to advance automation technologies while also working on further innovations at logistics sites.

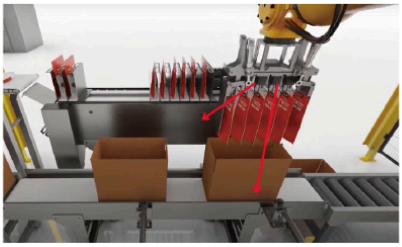
(JR Automation)

［14］Robot with product packaging

Depalletizer or palletizer moves material to/from pallet to/from conveyor.



End-of-line automation utilizes robots to pick up product and place in box.



Mixed-SKU depalletizers move different sizes and skus of product from palletizer to conveyor.

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Hitachi Review

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