

Industrial Digital Solutions

Connective Industries

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

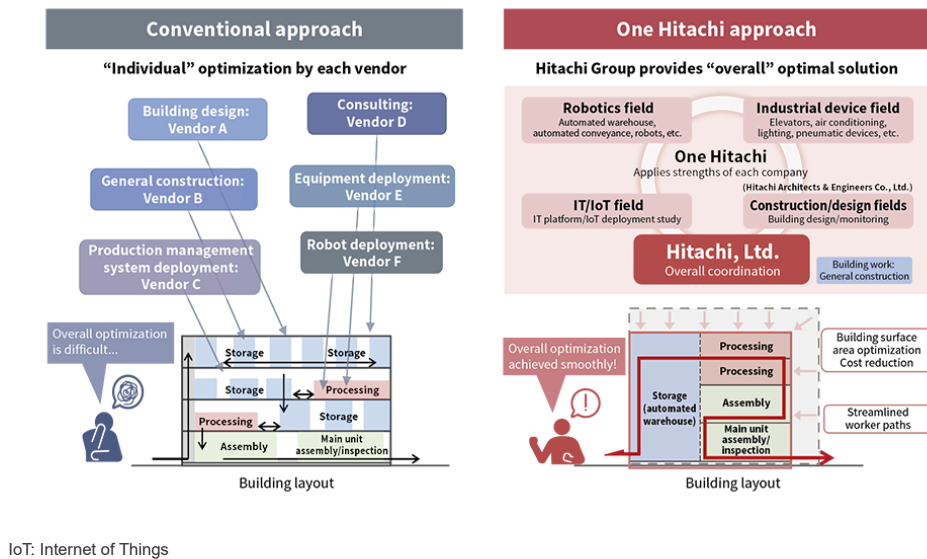
1. Approach for Overall Optimization of New Smart Factories, Including Building Concepts

The expansion of factories in recent years for semiconductors and other high-growth industries, together with the trend of domestic reshoring of manufacturing plants in response to COVID-19 and geopolitical risks, has led to a resurgence of investments in new factories in Japan. In addition, plants manufactured during Japan's postwar boom are now more than 40 years old, and the desire to renovate aging facilities is expected to further accelerate investments in new factories.

However, labor shortages and the soaring costs of construction materials have led to a significant rise in building costs year by year. In particular in mature industries, it is difficult to secure a budget for investment in new factories and many customers are facing this new issue.

As a means of solving this problem, the Hitachi Group has developed a "One Hitachi" approach that brings together the total power of the Group to combine smart factory concepts with innovative ideas about building design. This approach helps to provide the most optimal overall solution for the construction of a new factory. One example of a solution is to introduce automation to the production line to achieve a doubling of productivity, while also optimizing the layout to reduce the work area by half. This can reduce building costs, which make up more than half the investment costs when constructing a new factory, by as much as half, resulting in efficient new plant investments.

[01] Overall Factory Optimization with One Hitachi Approach



2. Quality CPS Solutions

At the same time as quality issues at global manufacturing companies are becoming a serious problem for society, technologies are reaching the stage of practical application, such as advanced analysis of manufacturing quality data and generative artificial intelligence (AI) that can search for and extract knowledge about malfunction countermeasures from a huge amount of documentation.

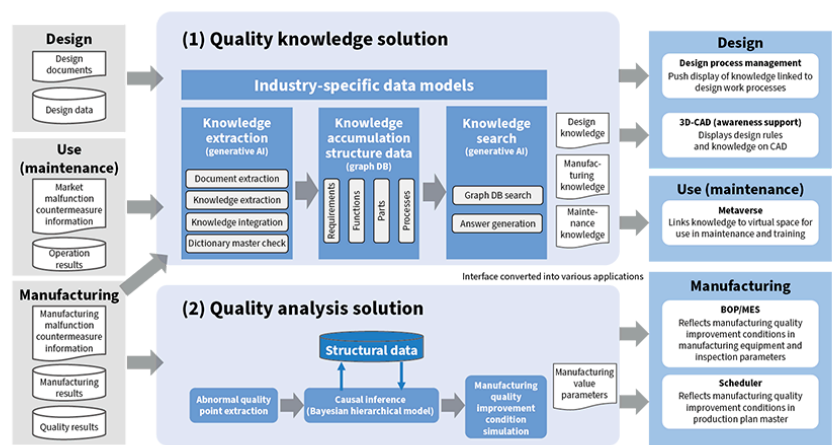
In this context, Hitachi has leveraged the knowledge of each manufacturer in the Hitachi Group to plan and develop two solutions that feature the following functions as "Quality CPS Solutions."

- Quality knowledge solution

- (1) Extracts countermeasure studies and recurrence prevention knowledge from various documents, such as malfunction reports.
 - (2) Maps and stores knowledge in schemes that include elements such as requirements, functions, and parts.
 - (3) Provides knowledge to users in design, manufacturing, and maintenance departments.
- Quality analysis solution
- (1) Automatically extracts data that can be statistically determined to be signs of abnormalities and data showing large deviations from the design values as abnormal quality points.
 - (2) Finds data items that have a strong causal relationship with the abnormal quality points, and clarifies the mechanism of events that occur.
 - (3) Changes the values of the data items that have a strong causal relationship, and simulates new manufacturing quality improvement conditions.

Through these solutions, Hitachi will prevent malfunctions and reduce the cost of malfunction countermeasures.

[02] Overview of Quality CPS Solutions



CPS: cyber physical system
DB: database
3D-CAD: three dimensions-computer aided design
BOP: bill of process
MES: manufacturing execution system

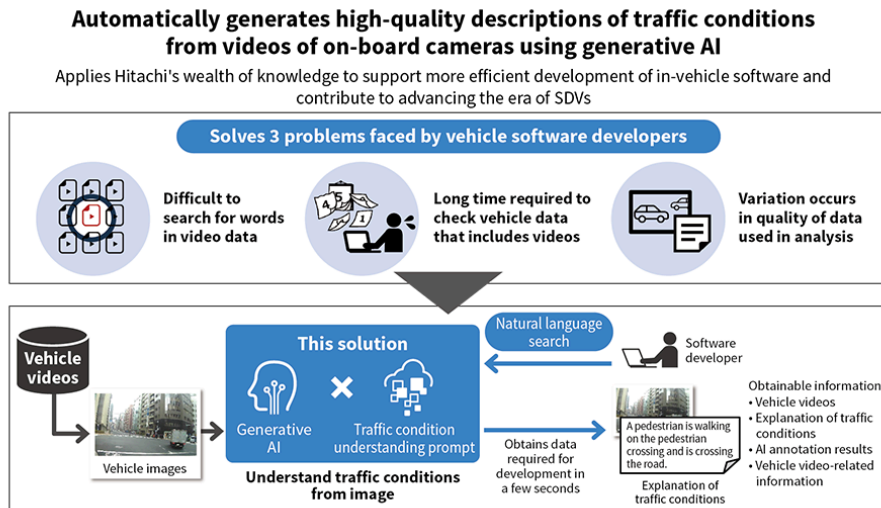
3. Video and Image Analysis Solution Utilizing Generative AI

Currently, attention in the automotive industry is focused on software defined vehicles (SDV)*, leading to increased development of vehicles where functionality and performance can be added via the software that controls the systems, rather than by changing the hardware. Therefore, data-driven software development will become the mainstream method in the future, where data obtained from vehicles is leveraged for software development.

In this context, Hitachi used generative AI to develop a solution that automatically generates high-quality descriptions of traffic conditions from the videos of on-board cameras, and enables the user to instantly search for the required video data using natural language. This solution was developed using proprietary prompts that apply Hitachi's wealth of knowledge in the automotive field. The solution helps to increase the speed of software development, shorten development times, and reduce development costs.

Application of this solution will not be limited to the automotive industry; its use is envisioned for a wide range of videos from different types of cameras. Hitachi aims to expand the solution beyond the automotive industry into other fields and thus to make an even greater contribution to society.

* A vehicle with functionality that can be boosted and performance enhanced even after sale by updating the software that controls the vehicle using a two-way communication function between the vehicle and external locations.



4. HDSM/Chain Traceability Solution

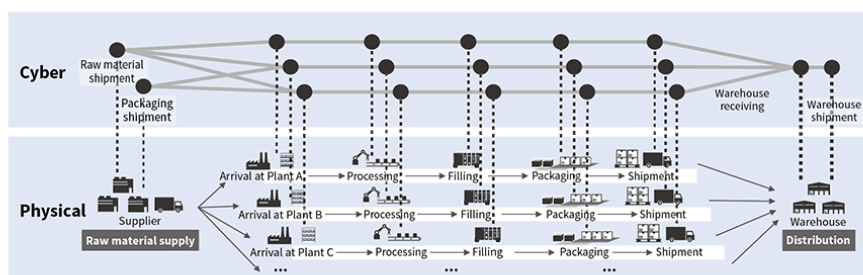
Beverage manufacturers must rapidly respond to inquiries from across the supply chain to ensure safe and secure products. However, individual systems are often used to manage the wide range of information generated through the entire process from shipping raw materials to the factory to manufacturing, distribution, and warehouse storage. This means that when an issue occurs, it can take a huge amount of time and effort to investigate and confirm the range of impact.

It was in this context that Hitachi developed the Hitachi Digital Solution for Manufacturing (HDSM)*/Chain Traceability Solution as a means of centralized management and tracing of information from manufacturing worksites (Physical) that extend across multiple locations as a single chain in digital space (Cyber). This solution can prevent in advance the risk of using raw materials that have already exhibited abnormalities during the manufacture of other products. Even in the event that problematic products are manufactured, the range of impact can be identified immediately, ensuring that products remain safe and secure, and greatly increasing work efficiency.

In the future, Hitachi aims to expand the tracing range to the entire supply chain to create consistent chain traceability across the entire industry.

* A group of manufacturing industry solutions that convert into assets the "value" of know-how and various customer co-creation initiatives that solved operational and production worksite problems of various manufacturers, and then systematize these assets for quick provision.

[04] Overview of HDSM/Chain Traceability Solution



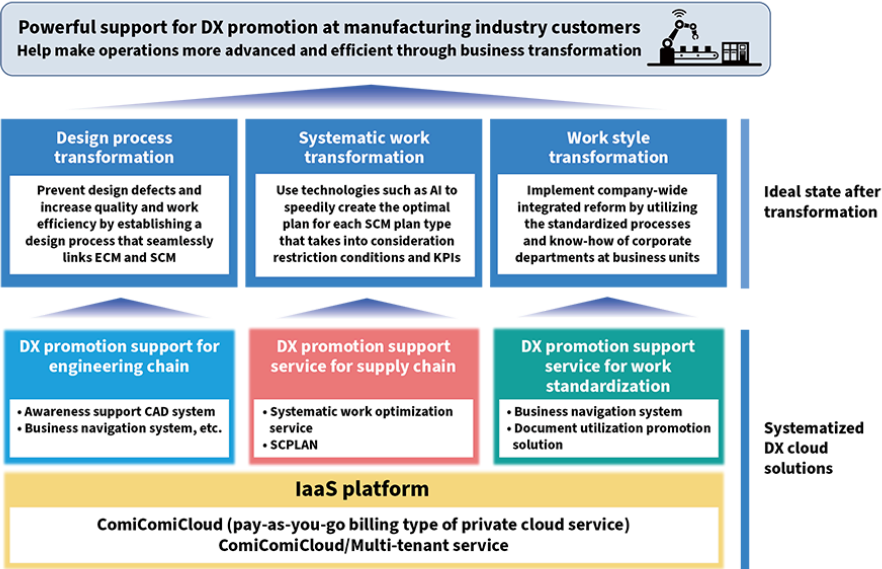
5. DX Cloud Solutions for the Manufacturing Industry

Recently, the issues facing the manufacturing industry are changing in ever more complex and interrelated ways, such as the decrease in the working population, the promotion of business that is considerate of the environment, and the general increase in uncertainties. In response to this, there is an urgent need to promote digital transformation (DX) based on digital technologies such as AI and data processing techniques.

To respond more effectively to the DX needs of customers, Hitachi has developed "DX Cloud Solutions for the Manufacturing Industry," which systematizes the operational technology (OT) and IT that Hitachi has cultivated as a manufacturer, as well as the wide range of knowledge and know-how (domain knowledge) that Hitachi has obtained by solving customer problems across the diverse fields and domains of the manufacturing industry.

DX in the manufacturing industry involves using data to visualize and analyze the various tasks of the engineering chain* and supply chain that are optimized individually under conventional systems, and then feeding back the results in the engineering chain for overall optimization. Another part of DX is to create optimal plans and speedy production plans based on the complex restrictions and key performance indicators (KPIs) of the supply chain, as well as strengthening operation standardization and problem-solving capabilities of corporate departments and then utilizing the know-how at business units as well. All of these solutions will help enhance the competitiveness of customers.

[05] Diagram of "DX Cloud Solutions for the Manufacturing Industry"



ECM: engineering chain management*
SCM: supply chain management
IaaS: infrastructure as a service

* See the list of "Trademarks."

6. Started Providing Services of Value Chain Integrated Management Platform to NIPRO

In May 2024, Hitachi started providing the services of the "Hitachi Value Chain Traceability service for Regenerative Medicine (HVCT RM)"*1 to use in the supply management of NIPRO's regenerative medicine, Stemirac®*.

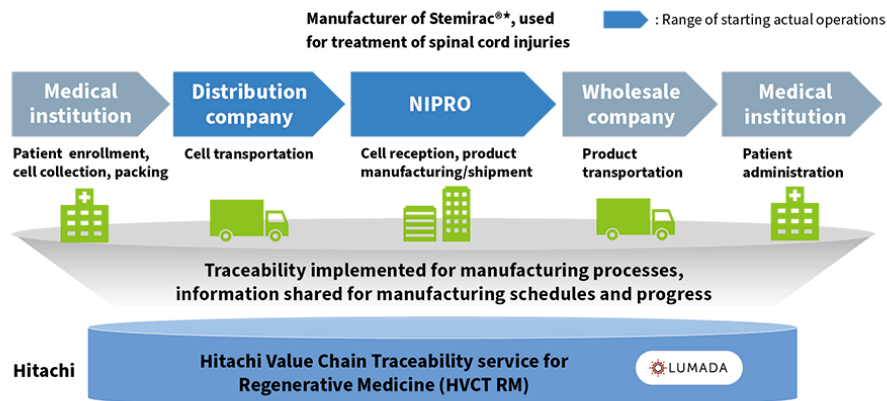
NIPRO has been manufacturing and selling Stemirac®* as a regenerative medicine for spinal cord injuries since 2019. They have adopted Hitachi's "HVCT RM" Lumada*2 solution for the centralized management of cell and tracing information across the entire value chain.

A wide range of information is input into "HVCT RM" throughout every process from cell collection to patient administration, including patient information, product manufacturing schedules, and the progress of each process. The result is a platform that can trace and share information for each entity, and Hitachi applies its proprietary anonymization and pseudonymization technologies*3 to provide a cloud service with high security. This makes it easy to expand management systems, and also results in highly reliable traceability, value chain optimization, and more efficient work.

* See the list of "Trademarks."

※1) Hitachi Value Chain Traceability service for Regenerative Medicine
※2) A generic term for solutions, services, and technologies that utilize Hitachi's advanced digital technologies to create value from customer data and accelerate digital innovation.
※3) Patient Registry Service

[06] Overview of “Value Chain Integrated Management Platform for Regenerative Medicine and Other Products” Introduced by Hitachi to NIPRO



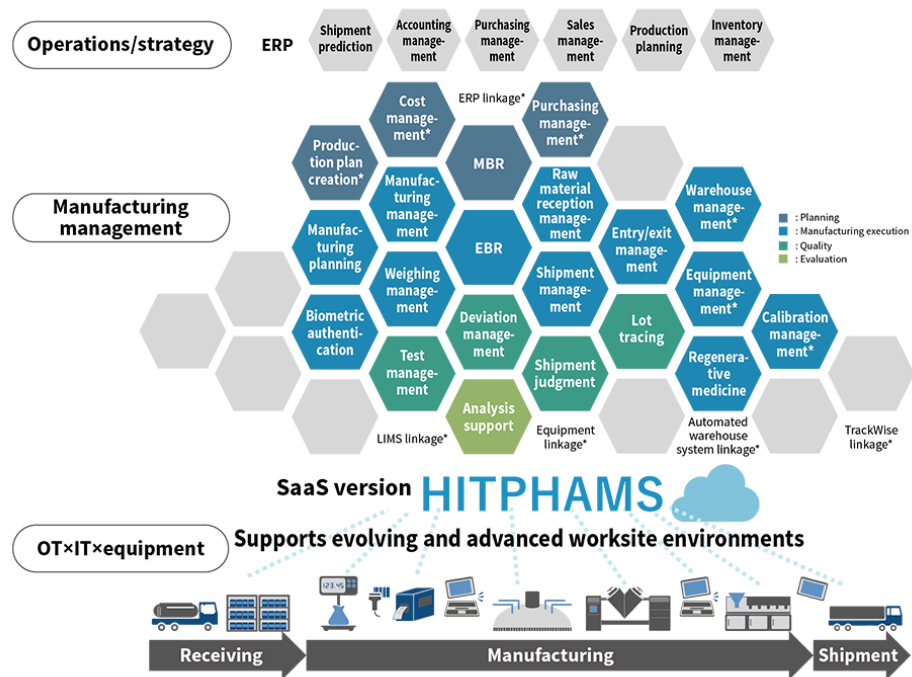
7. SaaS Version of "HITPHAMS"

"HITPHAMS" is an integrated package that is used in the production processes of various types of pharmaceuticals and medical devices. This package focuses on the manufacturing order management and manufacturing results management that are required by Good Manufacturing Practices (GMP; international standards related to pharmaceutical manufacturing and quality control) in order to implement strict manufacturing control and quality control.

As the recent shortages of IT human capital become ever more severe, the Software as a Service (SaaS) version of "HITPHAMS" is a way of providing solutions that lowers the barrier to customer adoption. Hitachi builds an individual utilization environment for each customer, and Hitachi takes care of the system operations and management that customers previously needed to perform themselves when using conventional on-premises systems. Since the SaaS version can expand functions whenever necessary, new functions based on the latest regulations, guidelines, and technologies can be utilized in a timely manner. Furthermore, this version eliminates the device procurement and verification that are required for the on-premises version, enabling speedy system deployment and start-up while restricting costs. This facilitates application of the package even for small-scale needs.

In the future, Hitachi aims to widely deploy the SaaS version of "HITPHAMS" across the pharmaceutical and medical device manufacturing industry as a Lumada solution that supports DX.

[07] Overview of SaaS Version "HITPHAMS"



ERP: enterprise resource planning
MBR: master batch record
EBR: electric batch record
LIMS: laboratory information management system
* Optional technologies

8. Full Factory Automation Solution

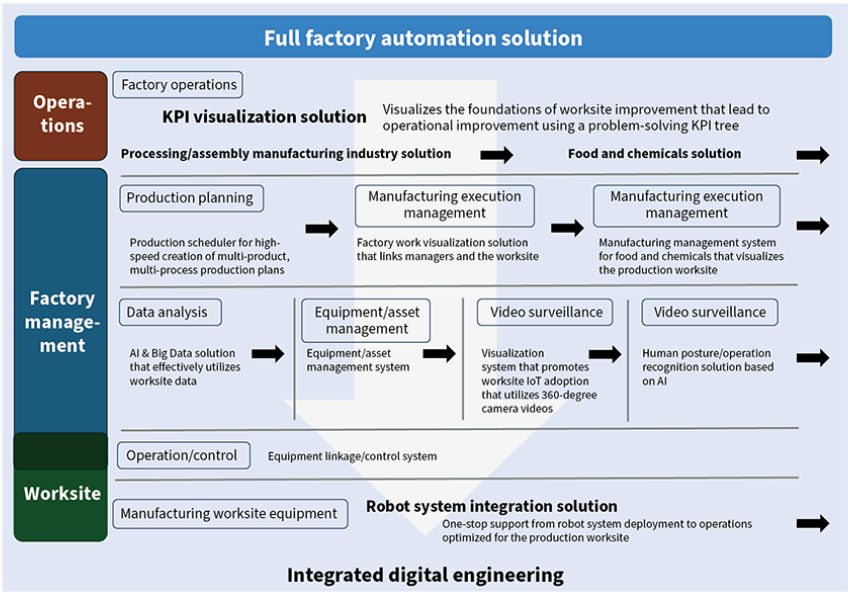
A pressing issue in the manufacturing industry is to escape from the dependency on human labor for operations as a part of the response to human capital shortages caused by an ultra-aging society.

The full factory automation solution solves the various problems faced by customers at medium-sized manufacturing plants. This solution automates manufacturing worksite and management tasks through the organic linking of information from operations, factory management, worksites, and various departments, resulting in the visualization of actual conditions that leads to overall optimization.

The full factory automation solution offers a rich variety of solutions in fields related to manufacturing plant operations, from business management to manufacturing execution and manufacturing worksites. This solution optimizes production plans according to received order and inventory information, responds flexibly to production plans, and establishes real-time monitoring of the manufacturing conditions and traceability for manufacturing and quality results. These and other actions help to increase value for customers.

(Hitachi Industry & Control Solutions, Ltd.)

[08] Full Factory Automation Solution



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The *Hitachi Review* website contains technical papers written by Hitachi engineers and researchers, special articles such as discussions or interviews, and back numbers.

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