

# Innovation for Advancing with Customers: Global Co-creation & Startup Collaborations

## Research & Development

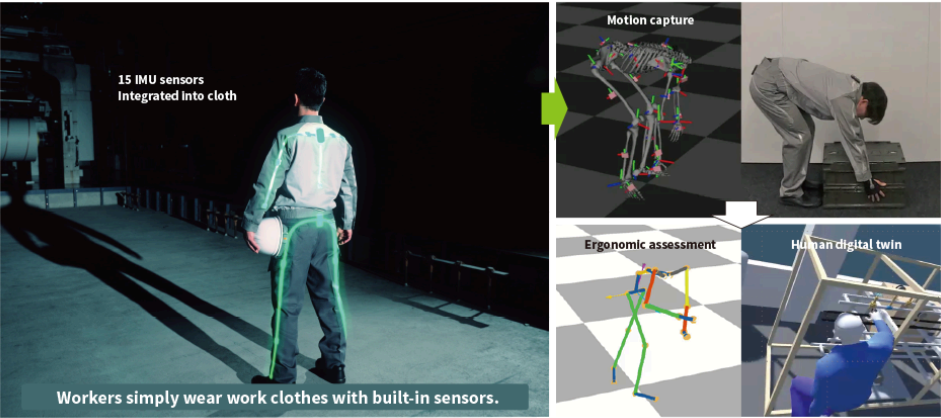
#Disaster Prevention and Resilience   #Innovation Creation   #Co-creation and Open Innovation   #Sustainability   #Generative AI   #Digital twins/Simulation  
#IoT/Data Utilization   #Research & Development

### 1. Smart Workwear Solution for Safe and Productive Workplaces

Hitachi has developed motion tracking technology and ergonomic assessment using smart workwear with inertial measurement unit (IMU) sensors integrated into clothing in collaboration with the German Research Center for Artificial Intelligence (DFKI), its spinoff company sci-track GmbH, and the smart apparel company Xenoma Inc. Realizing the digitization of worker movement and tasks without infrastructure in the environment necessitates the attachment of sensors onto the person, a process fraught with potential psychological resistance and logistical challenges. Leveraging Xenoma’s pioneering Printed Circuit Fabric technology, Hitachi has seamlessly integrated sensors into the standard workwear attire routinely worn by professionals in various industries. In a strategic collaboration with DFKI and sci-track, Hitachi’s advanced artificial intelligence (AI) technology has been carefully developed to rectify discrepancies arising from the inherent flexing of the fabric, ensuring motion tracking capabilities that are accurate, non-intrusive and avoid discomfort to the wearer. With the successful commercialization of this groundbreaking solution, the company stands poised to catalyze a paradigm shift, envisioning its widespread adoption across the industrial landscape, from factories to maintenance facilities and logistics operations.

(Hitachi Europe Ltd.)

[01] Smart workwear solution



### 2. IoT/AI-enabled Lone Worker Safety Solution for Rail Industry

A new wearable accident detection system using on-edge artificial intelligence (AI) and geolocated alerts to increase safety of lone workers maintaining rail transport infrastructure.

Keeping rail transport operational requires a dedicated workforce performing daily maintenance across large networks, including specialised lone workers. While workplace safety incidents are uncommon, due to robust safety procedures, an entirely accident-free working environment is not yet achievable.

Working within France’s Rail Open Lab innovation framework, Hitachi’s European R&D Centre collaborated with Hitachi Rail STS and SNCF Réseau to co-create a decentralized AI-powered solution to this challenge.

Worn on the worker’s wrist, the lone worker safety solution device is lightweight and intuitive to use. It combines multiple hardware and software accident detection capabilities. These include a lack-of-movement detection function and a human activity recognition AI-model, currently the fastest automatic detection method available.

Enabled by these cutting-edge technologies, this smart device automatically detects lone worker accidents and sends geolocated alerts to the emergency services. The worker can also manually activate alerts.

(Hitachi Europe SAS)

[02] Accident stages and wearable accident detection and alert device technologies



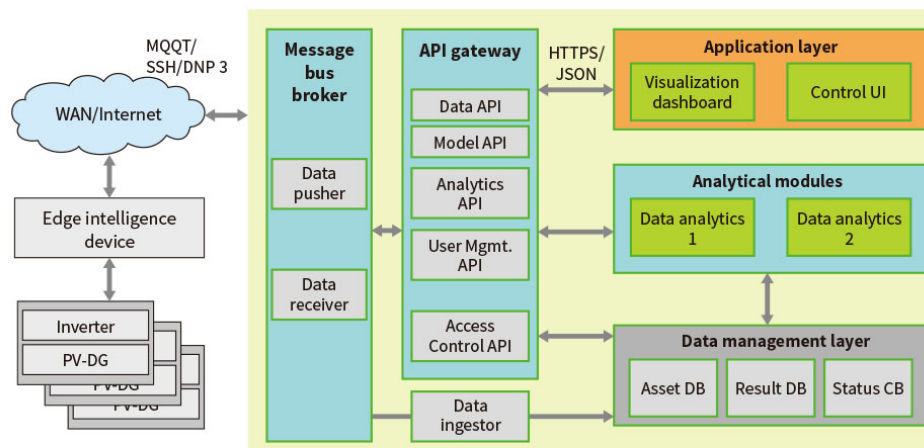
3. Solar Inverter Aggregation Platform for Distribution Grid Operation

Adoption of behind-the-meter distributed generation resources (DERs) has been rising in recent years. However, the large-scale integration of DERs in distribution systems is limited by factors such as (1) lack of DERs' situational awareness, (2) conservative interconnection rules, and (3) unstable interactions among inverters with uncoordinated control.

Hitachi focuses on solving these challenges through end-to-end solar energy optimization platform or E-Platform\*. E-Platform utilizes data-driven approach for operation and control of distribution systems. This platform receives data from inverters through the cloud for analyzing, visualization, and distribute control actions back to inverters. Coordinated inverter control in real time from centralized platform will reduce uncoordinated independent control problem, increase capacity limit, and grid resiliency. E-Platform enhances situational awareness for grid operators with various levels of distribution solar integration in their control area. E-Platform can help accelerate DERs' interconnection and operation of carbon neutral grid.

(Hitachi America Ltd.)

\* E-Platform is supported by the U.S. Department of Energy under award number DE-EE0008773. Hitachi acknowledges Arizona State University for their collaboration.



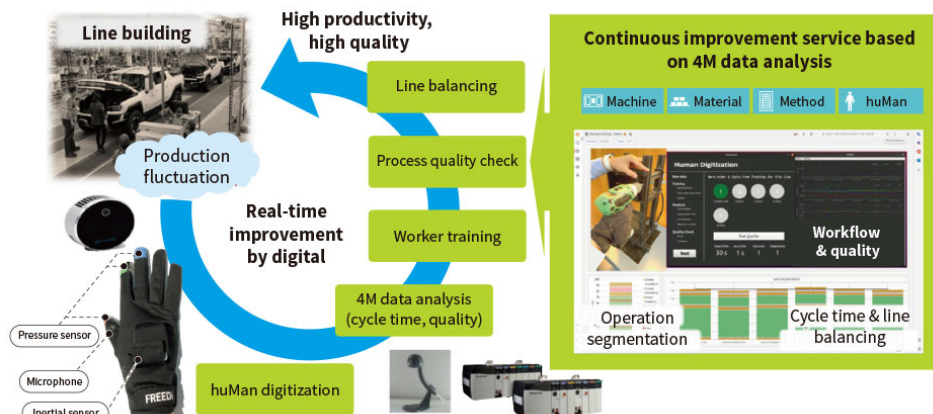
WAN: wide area network  
 PV-DG: photovoltaic-distributed generation  
 MQQT: message queuing telemetry transport  
 SSH: secure shell  
 DNP: distributed network protocol  
 API: application programming interface  
 HTTPS: Hyper Text Transfer Protocol Secure  
 JSON: Javascript object notation  
 UI: user interface  
 DB: database

## 4. 4M Solution for Guided Operations in Manufacturing

The manufacturing industry today is faced with increasingly dynamic environments filled with challenges such as the uncertainty of demand, supply chain issues, product customization and lifecycle management, etc. Especially in the USA, companies are also faced with an aging workforce, labor shortage, and skill gap issues. All these factors are having a significant impact on the production processes that involve manual operations. For example, in an automotive general assembly process, the resulting inefficiency can cause downtime, waste, energy over-consumption, and even safety concerns. To address these challenges and enable smart, resilient, and sustainable manufacturing for the future, Hitachi researchers in Japan and the USA are working on various hardware and software solution modules to digitize human operations, detailed task identification and tracking, process quality monitoring, ergonomics as well as safety analysis, etc. A huMan, Machine, Material, Method (4M) solution using Hitachi's glove sensor, location tracking, and advanced analytics has been demonstrated to multiple customers/factories in North America with a factory pilot currently being planned.

(Hitachi America, Ltd.)

### [04] 4M and digitized human operations for the future of manufacturing

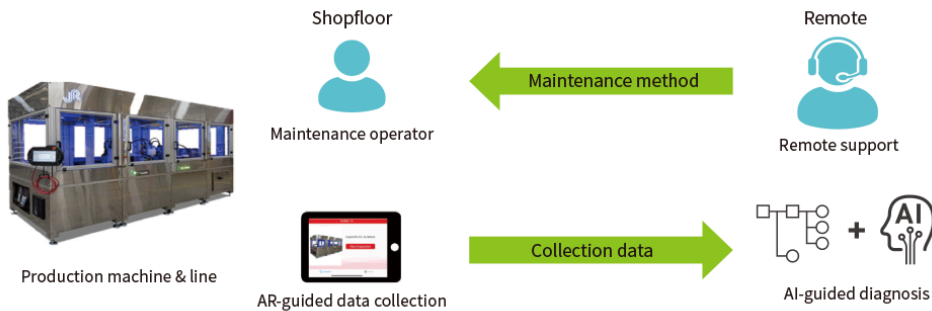


## 5. AI-based Solution for Guided Maintenance

Industry customers are struggling to maintain sustainable operations under a current labor shortage. In maintenance operations, customers face a challenge in how to reduce downtime by unskilled operators for corrective and preventive maintenance. When machine failures occur, operators identify failure phenomena, then they specify the causes, countermeasures, and spare parts to be replaced. Skilled operators can do that based on their knowledge, but unskilled operators need digital support. For such operations, operational technology (OT) knowledge is a fault-tree of hierarchically structured knowledge including failure phenomena, causes, and countermeasures. Therefore, Hitachi has developed a maintenance solution integrating OT knowledge and digital technology for skill-free operations. There are two features. One is augmented reality (AR-) guided data collection, another is AI-guided maintenance diagnosis. AR-guided data collection through a smartphone application can be supported to identify failure phenomena linked to the fault-tree. Then, AI-guided maintenance diagnoses based on generative AI can be recommended to specify the causes, countermeasures, and spare parts through interactions with operators. Based on the technology, Hitachi will try to solve customer challenge for sustainable maintenance operation.

(Hitachi America Ltd.)

[05] Concept of AI-based solution for guided maintenance

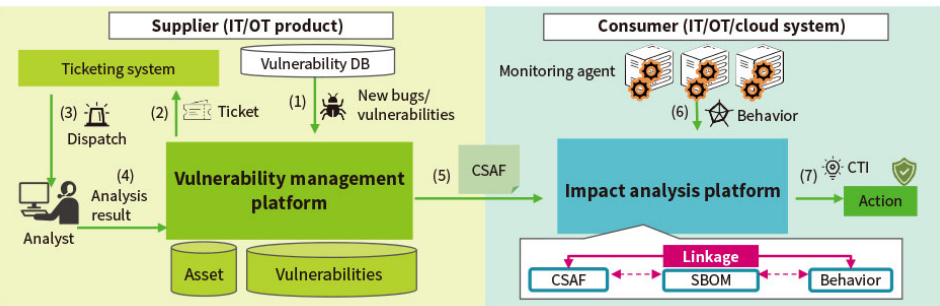


6. Vulnerability Management Technology Using SBOM

In the USA, software bill of materials (SBOM) and related machine-readable specifications like the Common Security Advisory Framework (CSAF)/Vulnerability Exploitability eXchange (VEX) are standardized and becoming mandatory in the energy, medical, and manufacturing sectors. Based on this background, Hitachi developed two kinds of technologies supporting security operations for suppliers and consumers. For suppliers, the company developed a vulnerability management platform that enables the orchestration of vulnerabilities, affected products, mitigations, and remediations that support the automatic creation of CSAF/VEX cybersecurity advisories. By using this platform, suppliers will reduce the cost of responding to many vulnerabilities. On the other hand, for consumers, Hitachi developed an impact analysis platform that enables it to link related information like SBOM, CSAF, and system behavior. Using this platform, consumers can easily identify the impact of disclosed vulnerabilities on their systems and clarify the response priorities. It will prevent overlooking the risks inherent in their system. Hitachi will develop a new security service in the USA by using the above technologies to comply with US regulations quickly.

(Hitachi America Ltd.)

[06] Security management platform for suppliers and consumers



7. Disaster Resilience Solution Using EVs

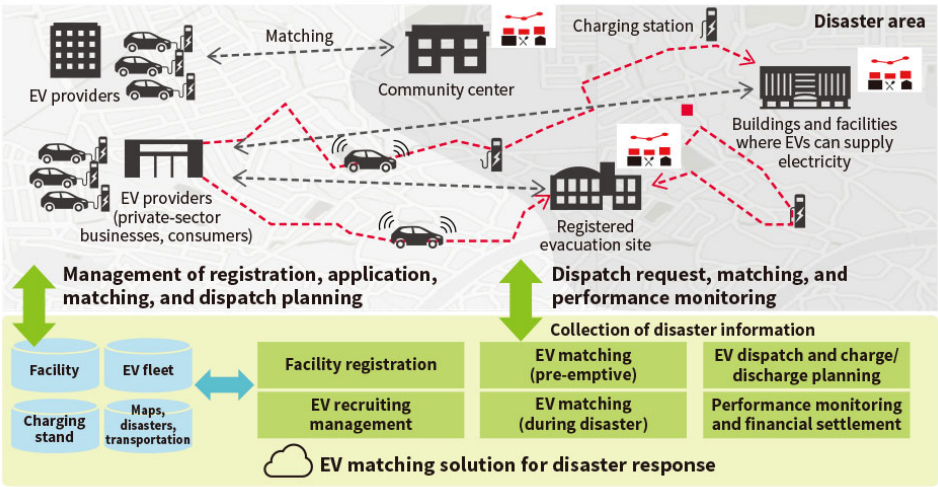
The rising severity of typhoons and other natural disasters is increasing the incidence of long-running interruptions in the supply of electricity. As electric vehicles (EVs) become more widely adopted, Hitachi has developed a solution that uses them to improve community resilience during disasters by treating them as mobile batteries that can store electric power during normal times, including from renewable energy.

The solution defines a system that is made up of evacuation sites and other such facilities together with EVs belonging to the public or to private-sector businesses such as local car dealers. It then formulates pre-emptive plans for how best to combine these. If the supply of electricity to the community is interrupted, downtime is reduced by devising EV dispatch and operation plans that are based on these pre-emptive plans.

Prior to a full-scale rollout, the solution concept was demonstrated using actual EVs at a disaster drill run by a local government in FY2022. This provided an opportunity to consult with local residents and confirm that the service would be well-received. This found that 73% of participants responded positively to the idea of making their EVs available during a disaster.

In the future, Hitachi intends to expand the system capabilities to provide community energy management functions that will be available for both routine operation and during disasters.

[07] Overview of disaster resilience solution using EVs

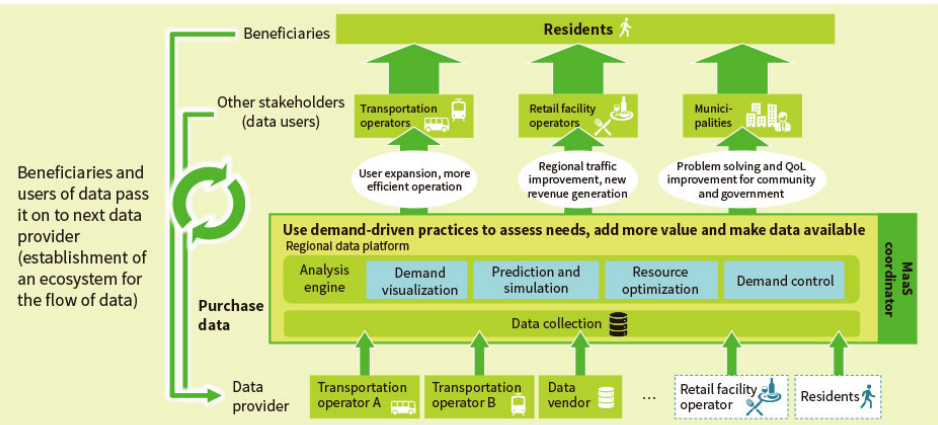


## 8. Enabling Use of Mobility Data by Transportation Operators to Optimize Local Transportation Resources and Demonstration Project in Fukuoka Area

Hitachi is seeking to establish a new business for coordinating mobility data, using this as a means of addressing a range of issues that include maintaining local transportation as part of the infrastructure of daily life, reducing the load on the environment, and revitalizing regional economies. Our purpose is to drive operational improvements across the different operators involved in a way that optimizes performance at the regional level, adding value to the mobility data held by local transportation operators and making it available.

What is needed to establish such a business is to build an ecosystem made up of numerous different organizations spread across different sectors, such as a mix of transportation and government services that operate on a medium to long-term business cycle alongside commercial businesses with strong cashflows that operate on shorter timeframes. Doing so leverages mobility data as a catalyst for economic activity, such as using it to coordinate resources across different transportation operators or generate travel demand by having transportation, retail, and tourism businesses come together to offer special tickets. It also establishes the means for it to function as a regional data platform. A demonstration project run by the Ministry of Economy, Trade and Industry commenced in the Fukuoka area in FY2022 to verify its viability. The project was expanded in FY2023 to encompass public transportation and other public services, using Fukuoka as a model case with the goal of commercializing the business and extending it to other cities.

[08] Block diagram of MaaS coordinator business



QoL: quality of life

## 9. Use of CRM for B2B Sales Workflows

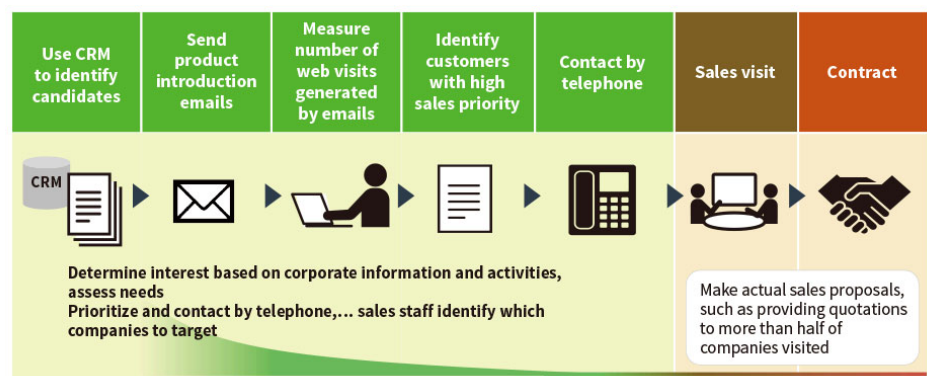
In the past, customer relationship management (CRM) at companies in the business-to-business (B2B) sector has mainly been used for existing customers and for the handling of sales activities. With the shortage of sales staff over recent years, however, and the trend toward customers using online information gathering, a growing number of companies have also been using CRM in their sales workflows for customer acquisition.

Hitachi Industrial Equipment Systems Co., Ltd. maintains CRM data containing information on customers encountered previously, such as those who have attended events. More recently, it has been seeking to improve closure rates by also using this data for inside sales targeting prospective customers. The workflow is made up of sending email to prospective customers to attract interest, using corporate information to prioritize sales efforts, contacting customers by telephone and talking to them to identify the most likely prospects, and then making face-to-face sales calls to the companies so identified. This workflow results in a more efficient sales process by making sales staff aware of the customer's issues and level of interest prior to meeting them and allowing staff to focus their efforts on the highest priority customers.

Hitachi intends to make greater use of CRM data in the future to strengthen engagement and to make the sales process more efficient and effective for both parties.

(Hitachi Industrial Equipment Systems Co., Ltd.)

[09] Workflow from identification of high-priority customers to actual sales

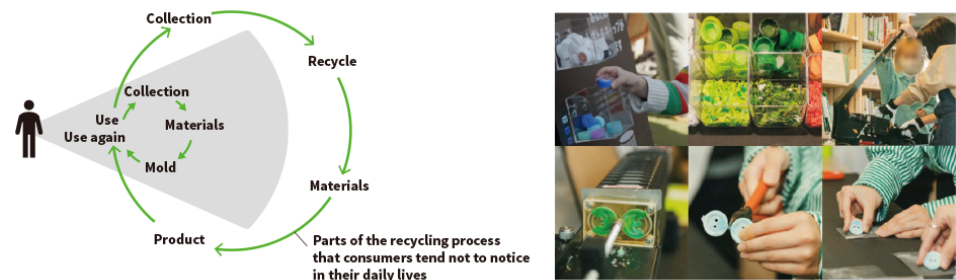


## 10. Design Research Method with Local Recycling Theme

Interest in regional circular economies is growing against a backdrop of global issues such as climate change and rising inequality, offering the relocation of production and consumption as an alternative to a globalized society based on high volumes of production and consumption. As part of joint research by Hitachi and Musashino Art University, studies of community life (specifically in Nagahama City, Shiga Prefecture) during the Edo period when society was characterized by a high level of recycling and in the early Showa era when vestiges of those former times were still evident were used to present a hypothesis about how these societies with their locally based recycling practices came about. The hypothesis was that the flow of materials is deeply connected to the cultural and social behaviors in which communities are grounded, and that recycling practices emerge from the interaction of the two.

This hypothesis is being used to inform work on social design aimed at creating the circular economy of the future. Feedback and insights were obtained from the CAP-NO-SONOGO, a plastics recycling trial with public participation that took place in Kokubunji City in November 2022 and involved making buttons out of PET bottle caps. Hitachi is now drawing on this knowledge to engage in community dialogue and prototyping with a view to putting such practices into action.

[10] CAP-NO-SONOGO, a plastics recycling trial with public participation



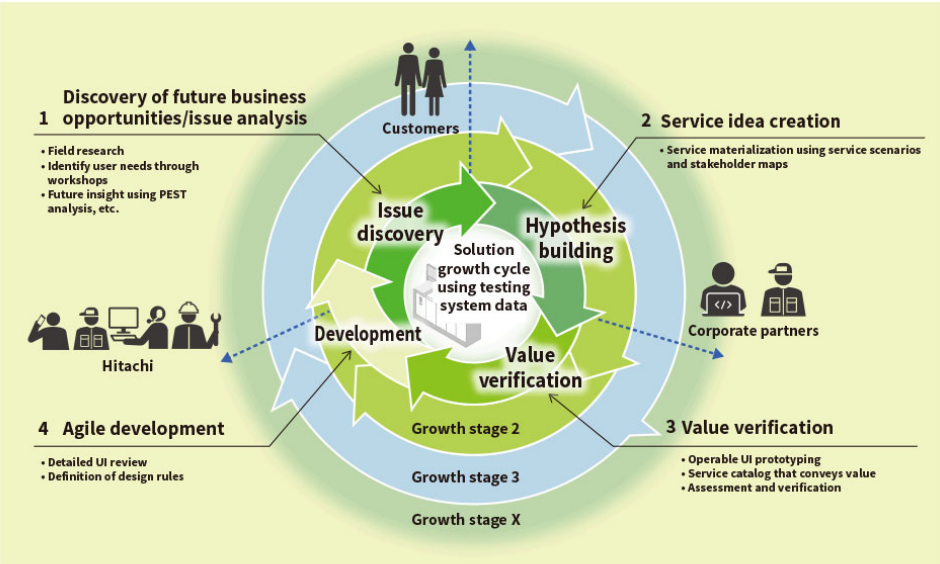
## 11. Development of Medical Solution Service Platform Using Data from Clinical Testing Systems

Hitachi High-Tech Corporation has commenced delivery of solutions for using data from customers' testing systems to improve the efficiency of laboratory testing, also launching the LABOSPECT PlaNet online system for service and product development that is tailored to how laboratories operate in practice.

The solution development process involved reviewing different possibilities for delivering value using an approach that combined forecasting (in which medical institutions in Japan and overseas were consulted to determine their needs) and backcasting (using data from testing systems to identify changes in laboratory practice). These possibilities provided a basis for getting the solution up and running through a repeated cycle of developing and improving the required functions and interface design along with testing and verification. A solution was then implemented on the system to provide information for the routine analysis preparation and administrative tasks performed by the laboratory technicians who use the testing system.

In the future, Hitachi intends to continue its use of testing system data to expand the delivery of value by further developing and extending solutions for customers and by supplying solutions for stakeholders inside and outside Hitachi.

[11] Solution development process for LABOSPECT PlaNet online system



PEST: politics, economy, society, and technology

# Hitachi Review

*Hitachi Review* is a technical medium that reports on Hitachi's use of innovation to address the challenges facing society.

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

*Hitachi Hyoron*  
(Japanese) website

<https://www.hitachihyoron.com/jp/>



*Hitachi Review*  
(English) website

<https://www.hitachihyoron.com/rev/>



## Hitachi Review Newsletter

Hitachi Review newsletter delivers the latest information about Hitachi Review when new articles are released.