Collaborative Creation with Customers

1 Vision Design Showing the Way Forward for Society 5.0

Hitachi is engaging in vision design[*1] studies whereby it works with other stakeholders to identify specific scenarios for Society 5.0 by raising issues from a consumer's perspective and presenting technologies and services for resolving them. This work is made public through events and the web, including Future Trust, which envisages new ways in which trust manifests in a digital society, and Fare Fund, which presents a vision for urban developments that strengthen community ties.

An important aspect of achieving vision-inspired social innovations is the establishment of an ecosystem for resolving issues. Accordingly, Hitachi has launched initiatives that include forums where industry, academia, and government can debate what forms society should take, such as the new Hitachi-UTokyo Laboratory, and the future living lab[*2] that works with community stakeholders to put ideas into practice.

In the future, Hitachi intends to help achieve Society 5.0, not only by pursuing business ideas through the formulation and publication of visions for the future and by putting them into practice, but also presenting these to international agencies.

*1 Vision design web page: https://www.hitachi.com/rd/portal/highlight/vision_design/index.html

*2 This takes a future-oriented approach to "living labs," meaning collaborative creation with user and community participation, also involving ongoing social experimentation in the places where people actually live.

1 Vision design process

2 Enhancements to NEXPERIENCE Using AI and Digital Technology

Hitachi has been working with customers on the collaborative creation of new services and businesses using its NEXPERIENCE methodology developed for this purpose. NEXPERIENCE, which provides methods and tools that support processes from analysis

of the issues through to the generation and valuation of ideas, has already been used more than 700 times.

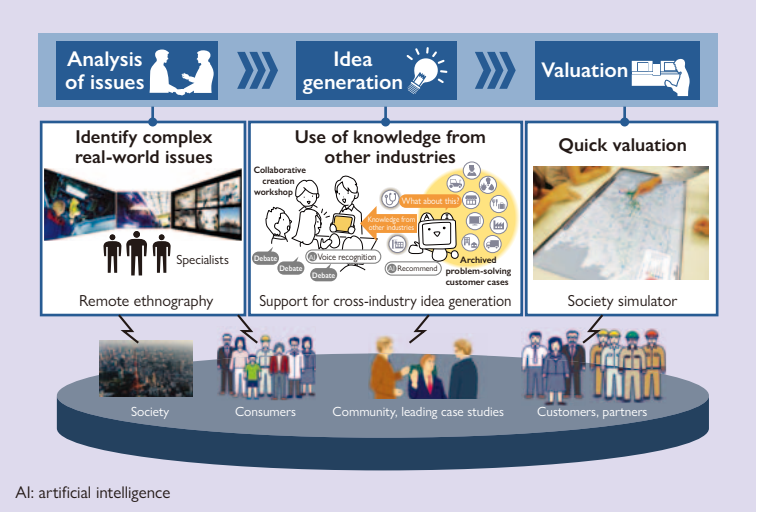
The progress of the digital revolution and the diversification of society's needs have not only made the issues facing companies and society more complex over recent years, but have also made the generation of innovative ideas more important. In response, Hitachi has utilized artificial intelligence (AI) and digital technology to add the following enhancements to the methodology.

(1) A tool for ethnographic research using a remote-control technique that helps the user to conduct research aimed at gaining an understanding of complex real-world issues.

(2) An idea generation tool that uses AI to perform voice analysis of workshop discussions and recommends customer cases of problem solving from the extensive range of businesses in which Hitachi is involved.

(3) A society simulator that uses digital data to share information about what is happening in cities and quickly assessed the value of proposed solutions.

Hitachi intends to continue developing NEXPERIENCE to help devise innovations that customers and society can use to resolve the challenges they face.



2 Enhancements to NEXPERIENCE using AI and digital technology

3 Remote Asset Lifecycle Management

Asset-intensive industries such as oil and gas, energy, and transportation are transforming their asset-centric business strategies from an asset-ownership model to a rental and fully contracted as-a-service business model. This transformation requires a change in asset management solution strategy that entails moving away from equipment-centric point solutions to an integrated asset lifecycle management solution extending to operations management and services and portfolio management.

3 Remote Asset Management Micro-Applications

The integrated asset lifecycle management solution will address three major challenges: (1) operational inefficiencies caused by the heterogenous mix of assets and large information silos; (2) increasing maintenance costs for aging assets installed over vast swathes of remote areas; and (3) regulatory pressures regarding safety, security, and sustainability. Hitachi's solution will be comprised of new measurements and analytics centered around the dependability of systems to better manage against shifting objectives of the industry from product-centric to services-inclusive business models.

For a major natural gas compression services provider, the integrated asset lifecycle management proof-of-concept (PoC) has been developed and demonstrated to monitor and analyze key compression operations with multiple fleets of remote compressor skids. Ongoing research is focused on defining and developing a new class of key performance indicators (KPIs) governing an integrated view of interaction between equipment, process, and service technicians.

4 Guangzhou Open Automation Lab. for Achieving Smart-manufacturing through Collaborative Creation with Customers

Hitachi Open Lab. Guangzhou – Open Automation Lab. (Guangzhou OAL) established by Hitachi (China) Research & Development Corporation is located at Hitachi Elevator (China) Co., Ltd. in Guangzhou Science City and serves as a collaborative creation space for the first research and development (R&D) facility to be established on the operational division's site. The laboratory opened on December 2nd, 2017 and had hosted more than 350 visitors from Hitachi and elsewhere as of the end of December 2018.

The Guangzhou OAL is made up of: (1) A discussion area in which digital content is used to facilitate collaborative creation, (2) A demonstration area in which a model production line is used to present operational technology (OT), and (3) A control area that collates data from the other two areas to demonstrate OT×IT in a way that is easy to understand.

The Chinese market demands an approach based on the use of demonstrations and other practical techniques to show customers what Hitachi is capable of, with prototypes being created early in the process so that collaborative creation with customers can be used to make further enhancements. Accordingly, Hitachi has created a place where it can show its technologies and products, using the videoconferencing system in the discussion area together with screen and model production line demonstrations.

Hitachi is also currently installing Lumada solutions at Guangzhou OAL and intends to generate innovation in the Chinese market with a sense of speed, working with other OALs and collaborative creation spaces around the world.

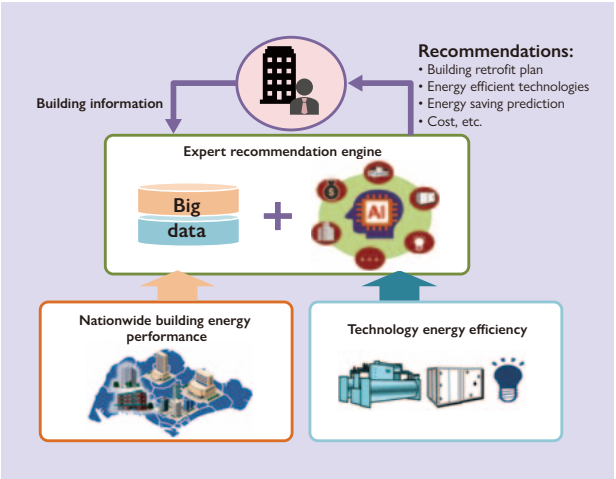
4 Guangzhou OAL

5 Building Energy Optimization Solution

Due to the hot and humid tropical climate in ASEAN countries, buildings consume a large amount of energy, mostly in air conditioning for occupants' comfort. Reducing building energy consumption while maintaining occupant comfort is a regional societal challenge for sustainable city development and quality living.

Building and Construction Authority, Singapore (BCA) has set a national goal to achieve at least 80% of the buildings in Singapore to be green by 2030. To achieve this goal, BCA has contracted Hitachi to develop a national building energy performance analysis platform. Through co-creation with BCA, Hitachi is developing an expert recommendation solution, leveraging big data and AI. The solution will offer shared experiences, best practices, and expert recommendations, such as building retrofit plan, energy saving prediction, and cost to apply energy efficient technologies, etc.

Utilizing this unique platform, Hitachi will collaboratively work with BCA to create advanced service to accelerate the adoption of green technologies in the building sector.

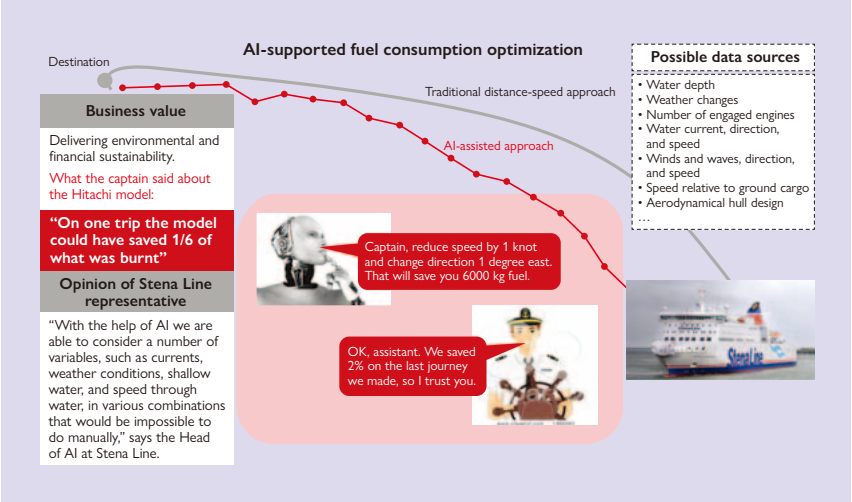


5 Overview of expert recommendation engine

6 Collaborative Creation with Customers for Fleet Management in Europe

Hitachi uses advanced analytics, including AI and machine learning (ML) to run co-creation projects with European customers on "fleet/asset intelligence for costs' reduction." An exemplary activity is the "AI Captain" co-creation project, where Hitachi is cooperating with Stena Line (a shipping company). Hitachi's AI-based solution recommends the most fuel-efficient ship navigation parameters (e.g. speed, power) while taking into account complex and dynamic environmental conditions (e.g. sea current, depth). It has been deployed and has been assisting the crew in navigating 2 vessels so far. Hitachi's "AI Captain" promised a potential 2-4% fuel savings. If judged successful, the solution will be piloting 38 Stena Line vessels starting from January 2019.

In parallel, Hitachi is contributing to co-creation projects with several other customers of Hitachi, particularly related to the application of innovative AI/ML technologies to the prediction of the remaining useful life (RUL) of fleets' and machinery components, to the forecasting of energy demand and plant allocation, and to the reduction of cost by improving operation efficiency.



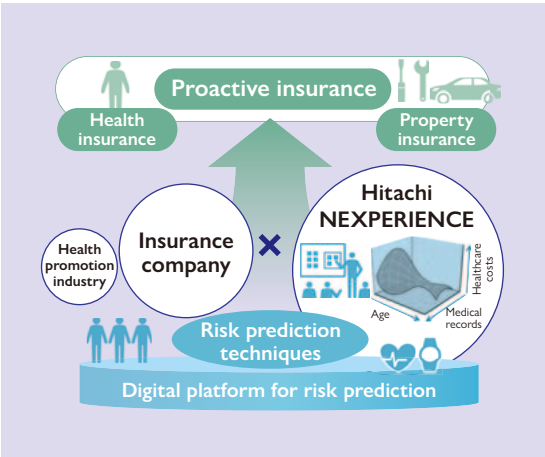
6 Overview of AI Captain

7 Innovation Design with a New Combination of Insurance and Digital Technology Based on Design Thinking Approach

The new tide of the Internet of Things (IoT) has expanded opportunities for innovation in the insurance industry. This has led to the emergence of a steady stream of innovative new services that can take advantage of real-time data points collected from sensors as well as conventional risk calculations based on statistics.

Hitachi has been working with insurance companies using its NEXPERIENCE methodology for creating innovations through collaborative creation with customers. The methodology is being used to take up the challenge of exploratory approaches based on design thinking to come up with a "new combination" of insurance with Hitachi's digital technologies. In particular, this work involves the collaborative creation of a new generation of health and property insurance, having created a concept of proactive insurance for providing preventive services in which insurance is combined with Hitachi's risk prediction techniques to identify the warning signs of things like accidents or disease.

In the future, Hitachi intends to take up the challenge of overcoming societal problems such as control of healthcare costs as well as expanding the business ecosystem by establishing a digital platform for risk prediction that links insurance companies with the health promotion industry.



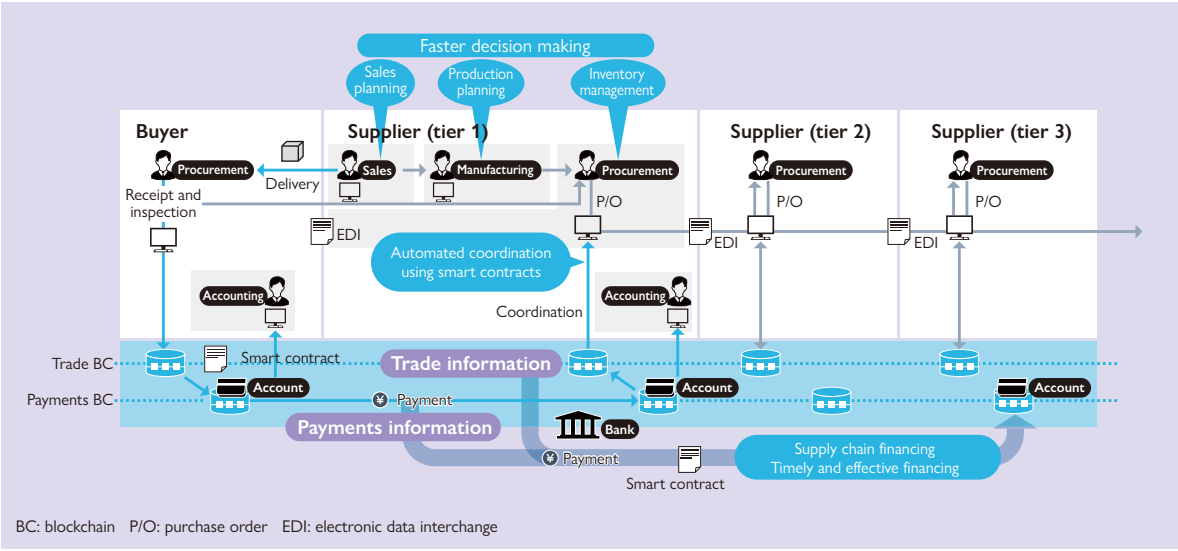
7 Innovation created by new combination of insurance with Hitachi's digital technology

8 Supply Chain Financing Using Blockchain

The structure of supply chain is changing away from the traditional pyramid structure with the product manufacturer at the apex and toward a horizontal model that has the flexibility to reconfigure in response to market needs. In this situation, blockchain technology that allows for open and secure transactions is expected to resolve the societal issues associated with supply chains, namely how to encourage trading between small and medium-sized enterprises and how to ensure traceability.

Hitachi has developed a prototype that provides drastic improvements in the efficiency of procurement and accounting while also speeding up decision making in production and sales planning by using a blockchain for the secure sharing of information about financial and commercial distribution in supply chains. The prototype is currently being trialed in Hitachi's own supply chain. Hitachi is also engaging in collaborative creation with a bank on the development of services that uses this information for real-time monitoring to satisfy the demand for funds of small and medium-sized enterprises in an appropriate and timely manner.

In the future, Hitachi intends to proceed with the practical introduction of these services and to establish a platform service that will help resolve the societal issues surrounding the industrial sector.



8 Supply chain financing

9 A Blockchain-based Financial Notary Service

Notary services have provided independent verification of data and events for hundreds of years. Often overseeing the signing of contracts, or the certification of records, they ensure that private individuals, companies, and governments can agree to a shared truth. In this digital age, the concept of a notary is being lost. Yet compliance with governance frameworks has never been more important, or more complex for financial institutions and public companies. Hitachi sees blockchain technology as the key to creating a digital notary service and creating a new business.

Blockchain technology, such as Hyperledger*, utilizes both linkages between sets of data, and hashing of data to prove that data has not changed over time. Imagine if a set of financial records has a cryptographic hash performed that represents the original data. At any time, a person could compare the data to the hash output and mathematically demonstrate that the data has not changed. Hashing future data would then incorporate parts of the prior dataset's hash, linking the data together over time.

Another aspect of blockchain systems are that they can be distributed. To ensure data integrity, the data proofs are immediately copied to multiple nodes or instances of the system. These nodes can each be controlled by a different company. This network of systems can contain data from many companies that each help ensure that all the proofs are secure. Since these hashes only verify data, a digital notary service can hold these copies of the "proof" without actually possessing the original data which could be confidential.

The Financial Innovation Laboratory believes that there will be business opportunities both in developing these systems, and in running these notary-type systems as an independent auditor and moderator. Unlike traditional notary services, Hitachi never needs to actually see the details of a transaction to be able to verify it. This means that subscribers to such a system can maintain a high degree of confidentiality and security to their data.

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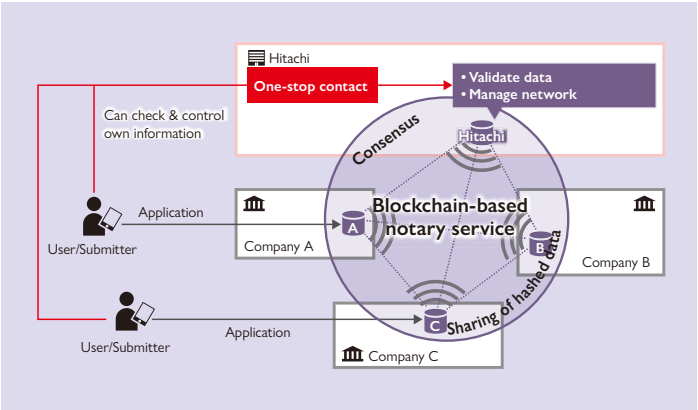
* See "Trademarks" on page 158.



9 Blockchain-based Financial Notary Service

10 Solution for Unattended Items

Concerns over recent years about bombings and other terrorist acts at public places such as airports and railways have raised the problem of what to do about items of luggage that have been left unattended at such places. As incidents of this type have resulted in facilities going into lockdown or being evacuated, there is a need for ways of rapidly identifying such items and tracking down the person who left them there. As this is a task that in the past has been handled in person by security staff, the resulting problems have included inadequate monitoring and higher costs.

10 Screen used to search for and track individuals based on their external appearance

Since 2017, Hitachi has been participating with a European airport in a PoC project involving the use of AI-based video analysis for public security. This includes promoting the digitalization of airport security operations by combining the automatic detection of unattended items in video from airport surveillance cameras with searching for and tracking individuals based on their external appearance.

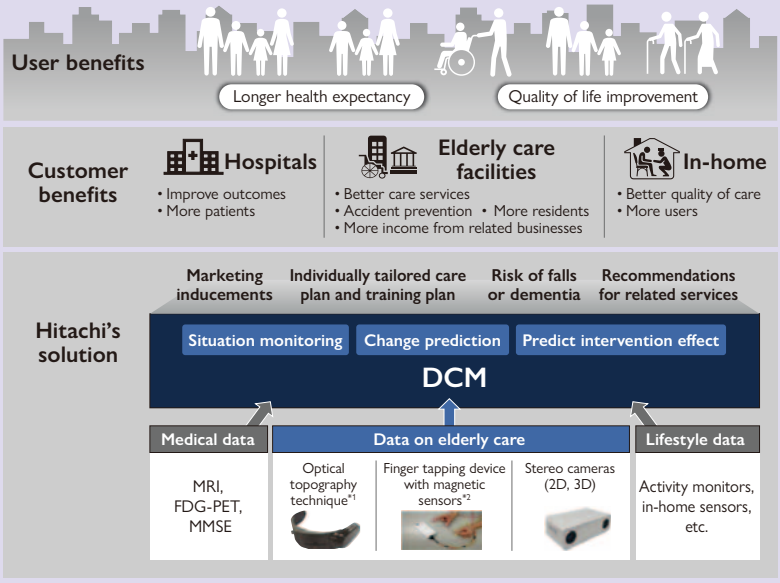
A trial that replicated an incident at an airport received a positive response from the customer, achieving an 80% success rate for automatic detection and suspect tracking. Because it does not rely on techniques such as facial recognition to identify people, the solution is particularly suited to applications where it is difficult to obtain a front-on view of people's faces, such as when using ceiling-mounted cameras, and in public areas where there is a risk of privacy violation. Moreover, because it uses existing infrastructure such as surveillance cameras, it also enables airport-wide surveillance and suspect tracking to be provided quickly and at low cost. Another potential application for the solution is to use it to look for passengers who are late for their flights, missing children, or lost property.

11 Elderly Health and Care Solution for China that Helps Prolong Healthy Lifespans

The establishment of elderly welfare programs is an urgent mission for China where the population is rapidly aging. Of particular concern is how to deal with elderly people who are bedridden or suffer from dementia. In response, based on the concept of prolonging healthy lifespans by encouraging the elderly to be self-reliant, Hitachi is looking to supply solutions to Chinese providers of elderly care services who are facing difficulties due to a shortage of specialist care staff.

Drawing on experience and expertise gained from the provision of medical and welfare services to the elderly in Japan, and utilizing IoT technologies that include data analysis and advanced measurement techniques such as optical topography, a finger tapping device that uses magnetic sensors, and stereo cameras, Hitachi is working to develop a digital care management (DCM) solution that helps to improve the service quality and efficiency of providers as well as preventing or delaying the onset of physical incapacity or dementia. This work has already demonstrated the extent of demand for such solutions in China through exhibiting at trade shows and by undertaking trials at elderly care facilities.

In the future, Hitachi intends to help improve the quality of life for the elderly and reduce social security costs in China by taking steps to achieve early commercialization.



MRI: magnetic resonance imaging FDG-PET: fludeoxyglucose positron emission tomography
MMSE: mini-mental state examination DCM: digital care management
*1: HOT-1000 built by NeU Corporation
*2: Prototype (non-medical device) built by Maxell, Ltd.

11 Overview of solution for elderly in China

12 Better Educational QoL in India: Digital India

India is undergoing a rapid digitalization, including the Digital India policies for e-governance (putting government services online) and e-education (doing the same for educational services).

Hitachi India Pvt. Ltd. and Hitachi Consulting Co., Ltd. have been working on devising solutions that will contribute to the Digital India policy through workshops using the NEXPERIENCE methodology for collaborative creation with customers. The workshops look at the societal challenge posed by the educational quality of life (QoL) in India compared to that in developed nations and generate solution ideas such as a teacher evaluation service that utilizes feedback from parents or guardians, or a commuting service for children that ensures they can get to and from school safely.

In the future, Hitachi intends to put these solution ideas into practice by prototyping them and running PoC trials with local customers.

12 Idea creation at NEXPERIENCE workshop