



JFE

JFE Group

DX REPORT

2021

Contributing to society with the world's most innovative technology



DX銘柄2021
Digital Transformation

CONTENTS

- On the Publication of the DX REPORT 2021 — 02
- JFE Group's DX Strategy — 03
- DX Initiatives — 05
 - Steel Business
 - Engineering Business
 - Trading Business
- Groupwide Initiatives — 19
- DX REPORT 2021 Topics — 21

Disclaimer

Current plans, strategies, beliefs, and other content described in this report that are not historical facts are forward-looking statements that may involve risks and uncertainties. Actual results, performance, or achievements could differ significantly from the anticipated outcomes presented in this report due to various factors, including changes in the global or domestic economy, as well as unanticipated trends in the industries to which JFE Group companies belong. Readers should understand that JFE Holdings cannot guarantee the certainty of such forward-looking statements.



Biggest transformation in the JFE Group's history, with DX strategy as the key

The JFE Group's operating environment is undergoing major drastic, unprecedented changes including a medium- to long-term decline in domestic demand, intensified global competition, responses to climate change like carbon neutrality, and the COVID-19 pandemic.

To respond quickly and flexibly to these changes, last May, we formulated and announced the Seventh Medium-term Business Plan, covering the period from fiscal 2021 through fiscal 2024, with the aim of steadily increasing corporate value over the medium to long term. We view the period of this medium-term business plan as the biggest transformation in the Group's history and have positioned our digital transformation (DX) strategy as one of the most important policies affecting the success or failure of that transformation. In August, we held a briefing on the JFE Group's DX strategy*1 to clarify the content of the strategy internally and externally.

Each JFE Group business is facing intense competition globally, but the vast reserves of data, expertise, and technologies we have built up over many years are valuable assets that other companies cannot easily imitate and the source of the value we create with high competitiveness. DX is an indispensable strategy for making maximum use of these assets. We have been working vigorously to optimize internally for increased productivity through initiatives including our ongoing introduction of cyber-physical systems (CPS) for all steelmaking processes at the Steel Business and linking data at the Engineering Business to transform operations at construction and other worksites. Going forward, we will also pursue the challenges of providing added value externally and creating new businesses by building an external service sales platform at the Steel Business, providing preventive maintenance and management services for boiler power plants at the Engineering Business, and using digital technologies to create new businesses at the Trading Business. We hope to take our DX strategy to a new level and use it as a foothold to convert environmental changes from risks into opportunities for growth.

At the same time, the expansion and evolution of the DX strategy can be seen as heightening the importance of addressing the risks of increasingly sophisticated and complicated cyberattacks and information leaks. Our security management activities, which protect our information assets and ensure that business activities are carried out safely, are extremely important and an integral part of our DX strategy, and we are strengthening our security measures and governance, primarily through JFE-SIRT*2.

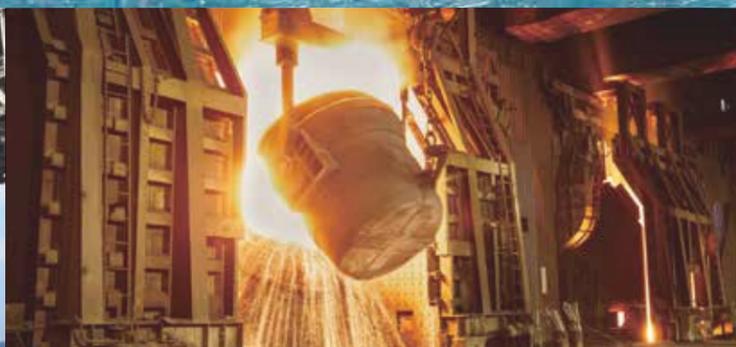
This report provides details on the specific content and success of the DX strategies at each operating company and initiatives being carried out across the Group. I hope this report provides useful information that helps readers better understand the JFE Group's DX initiatives.

*1 JFE Holdings corporate website (News Release section) (in Japanese only)

*2 JFE-SIRT: JFE-Security Integration and Response Team



Seiya Kitajima
Vice President
JFE Holdings, Inc.



JFE Group's DX Strategy

JFE Group's stance on DX

The JFE Group's operating environment is undergoing major drastic changes

- Intensified global competition (emergence of Chinese steel mills, etc.)
- Climate change issues
- Falling domestic demand from population decrease
- Global economic uncertainty from U.S.-China confrontation
- COVID-19 pandemic
- Generational change among skilled engineers, aging of manufacturing facilities, etc.

The Group needs to establish a resilient management base for continuous growth (biggest transformation in Group's history)

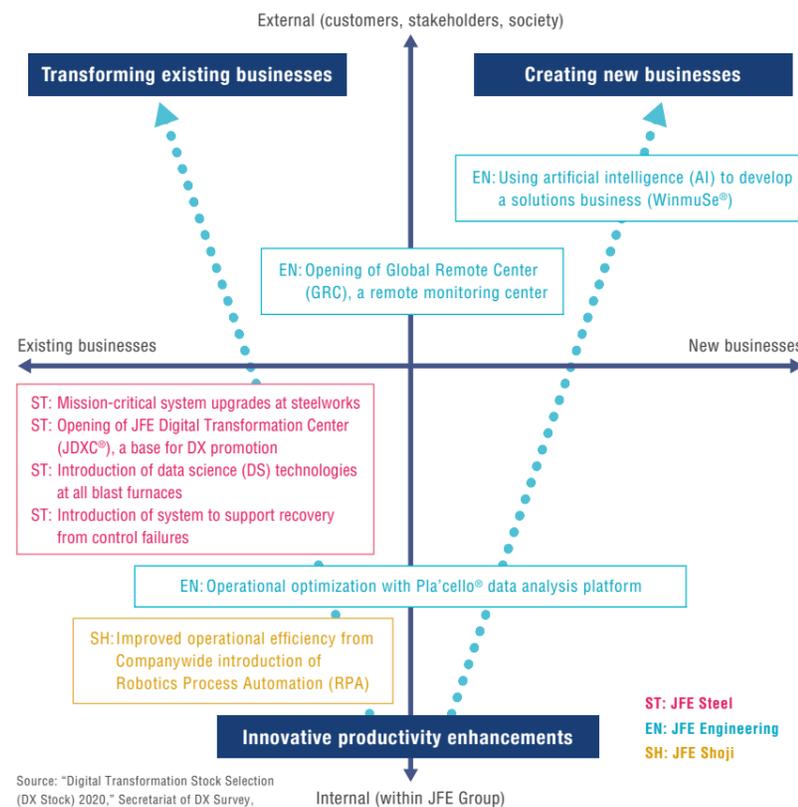
- Transformation to a streamlined, resilient business structure
Steel Business: Successfully implement structural reform, shifting from quantity to quality
- Maintain top levels of cost and quality competitiveness globally
- Pursue new growth strategies (Globalize, identify, and pursue growth areas and new businesses)
- Address climate change issues

Strategy in which DX is key to biggest transformation in Group's history

Achieve DX by introducing large-scale, cutting-edge information and communication technology (ICT) and digital infrastructure to make maximum use of the Group's wealth of data, expertise, and technologies (= source of competitive strength)

⇒ Business transformation, creation of new value-added products and services, risks from environmental change leading to growth opportunities

Initiatives to date



- Strengthening of manufacturing base began with initial focus on "innovative productivity enhancement (internal optimization)," contributing significantly to improved operational efficiency
- Using accumulated expertise to pursue challenges of "transforming existing businesses" and "creating new businesses"

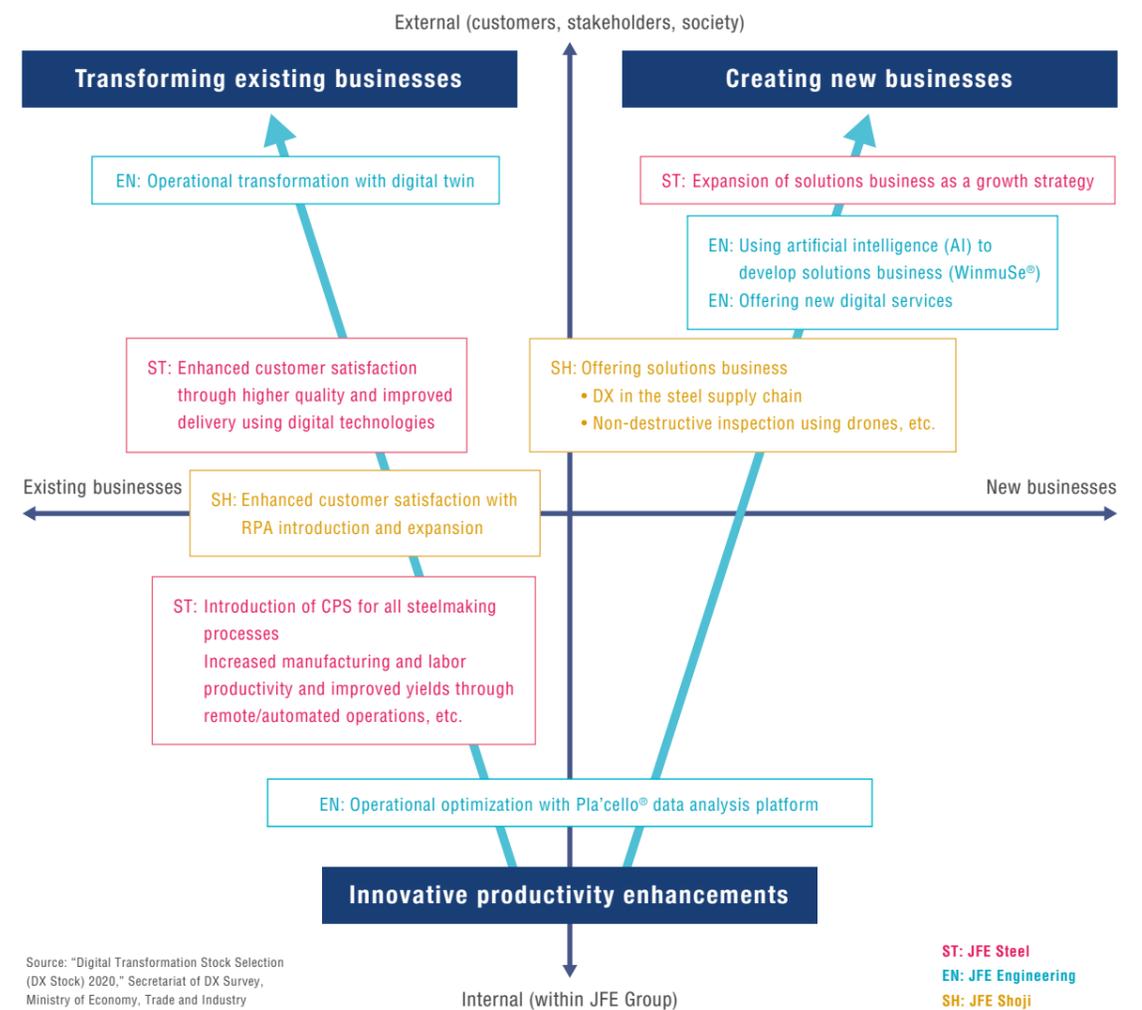
- Digital Transformation (DX) Stock Selection 2021 designation (seventh consecutive year) (jointly announced by Ministry of Economy, Trade and Industry, and Tokyo Stock Exchange)



Comments received

- Use of DX seen as central to transformation of business model
- Leader in use of DX in engineering

Initiatives under the Seventh Medium-term Business Plan (FY2021-24)



Source: "Digital Transformation Stock Selection (DX Stock) 2020," Secretariat of DX Survey, Ministry of Economy, Trade and Industry

ST: JFE Steel
EN: JFE Engineering
SH: JFE Shoji

- Build on successes with greater focus on more efficient manufacturing and stronger competitiveness through "innovative productivity enhancements"
- Targeted focus on "transforming existing businesses" and "creating new businesses" through stronger external activities going forward, based on technologies and data built up through activities to date
- Systematically invest capital, human resources, and other management resources as necessary: **DX investment of roughly 120 billion yen over four years**

Overview of DX strategy targeted at each operating company

- JFE Steel**: Establish competitive advantage by making maximum use of data built up over many years
- JFE Engineering**: Make further use of data for drastic operational transformation and offer new digital services
- JFE Shoji**: Provide customers with innovative value

Groupwide initiatives

- Responses based on digital governance
- Groupwide cybersecurity measures
- Further exploration of Groupwide themes

Steel Business

(JFE Steel Corporation)



The “sophistication of data use” is the essence of JFE Steel’s digital transformation (DX).

The IT Innovation Leading Department and the Business Process Innovation Team are integrating IT platforms, including systems upgrades at steelworks. By linking expertise and data accumulated to date (the Integrated DB) with images and sensor data obtained with the latest technologies, we are building a platform that can fully use this data to further increase customer value.

At the same time, we are addressing increasingly sophisticated cyberattacks by implementing swift and comprehensive risk countermeasures for the entire Group, led by the JFE-Security Integration and Response Team (JFE-SIRT). We are also raising the level of our security management with the intention of migrating to “zero trust” architecture as a new security model.

Our DX aims to strategically use the huge wealth of data on a secure IT platform to achieve a preeminent strategic position.

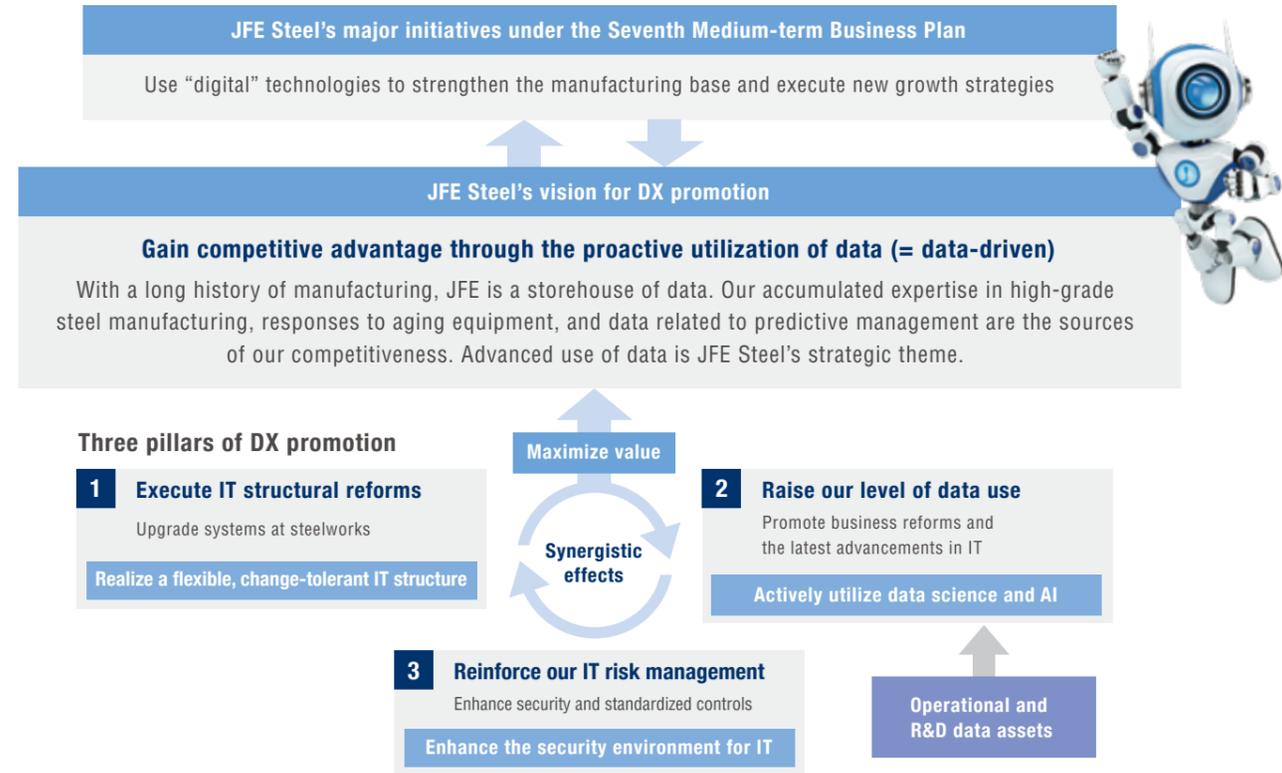
The core of “advanced use of data” in manufacturing is the realization of CPS for blast furnaces at all steelworks. Our development of all processes going forward will simultaneously achieve sophisticated automation, stabilization, and high efficiency of operations with high product quality. Ultimately, we aim to integrate all CPSs on an information technology (IT) platform to create a CPS for an entire steelworks, to realize “intelligent steelworks” capable of executing optimal automated operations. We will also pursue cutting-edge technological development with a view to marketing these technologies externally.

In addition, we will use cutting-edge technologies for the large-scale passing on of skills, conversion of knowledge and expertise to artificial intelligence, and robotics to raise by several levels people’s working capability, increase labor productivity, and transform workplaces into more comfortable environments.

Regarding the cultivation of the DX human resources (internal data scientists) who will be the key individuals in the use of data assets and information and communication technology (ICT), we will create more extensive data science tools and will also reinforce our frameworks and activation measures for human resource cultivation as we work to strengthen the driving force behind our DX propulsion.

Vision for DX promotion

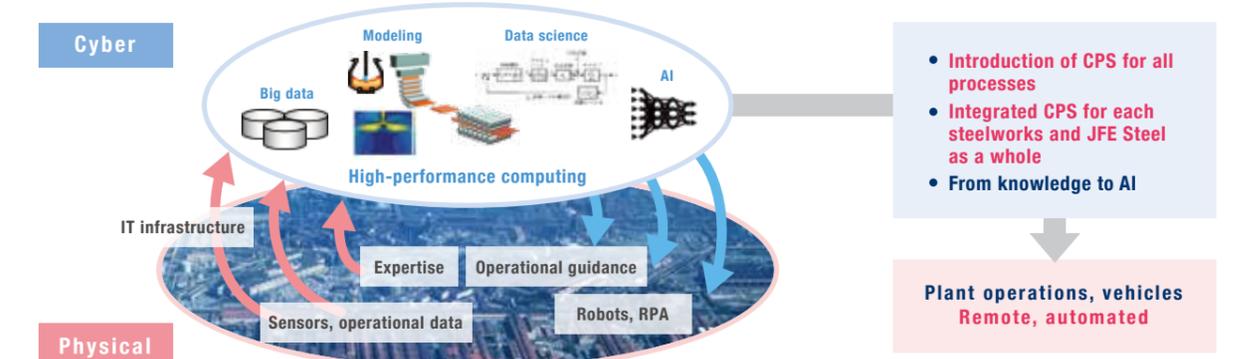
The main pillars of JFE Steel’s DX are the introduction of technologies like the Internet of things (IoT), artificial intelligence (AI), and data science (DS) for gaining a competitive advantage by proactively utilizing data (= data-driven). We have a longer history of manufacturing than companies in other countries, and our various types of data are invaluable. Our accumulated expertise in high-grade steel manufacturing, responses to aging equipment, and data related to predictive management are the sources of our competitiveness, as we make the advanced use of data one of JFE Steel’s important strategies.



Toward intelligent steelworks

We aim to realize “intelligent steelworks” by integrating all CPSs on a data platform to create a CPS for an entire steelworks that carries out optimal automated operations. We are also developing remote and automated plant operations and vehicle operations.

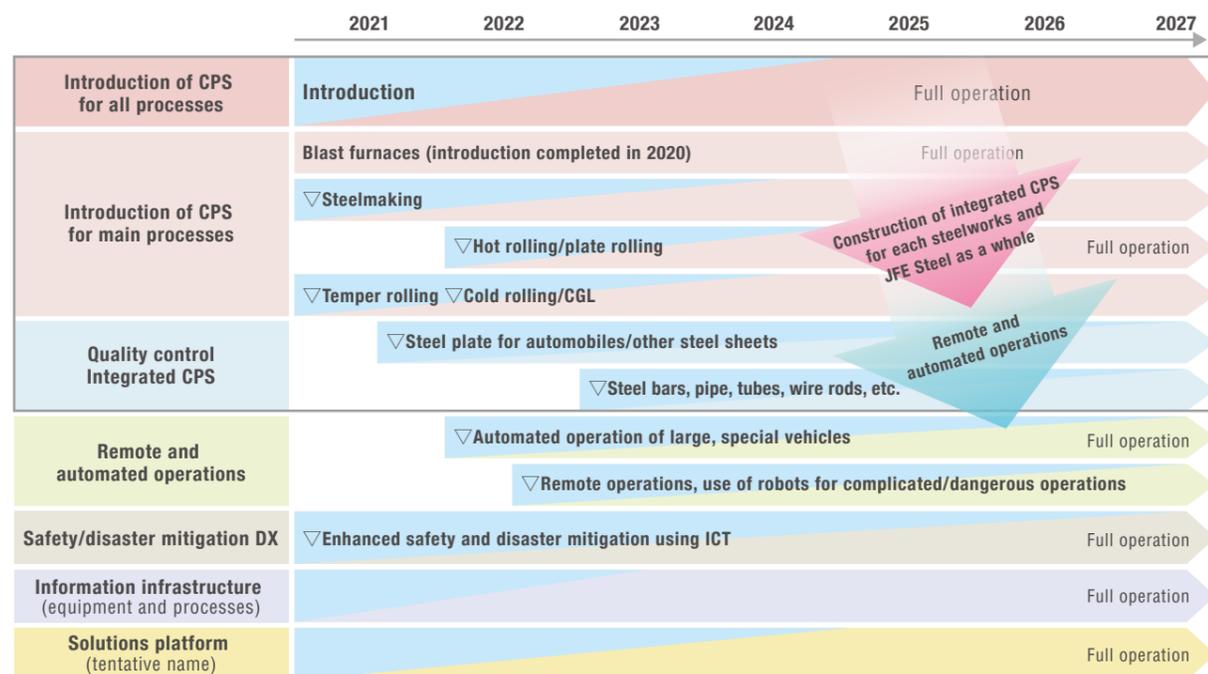
Intelligent steelworks that learns on its own to autonomously carry out optimal automated operations



Objectives and results of CPS implementation	Products and services	• Higher yields	• Enhanced quality assurance and quality	• Expedited development
	Processes	• Enhanced efficiency and productivity	• Cost reductions	• Prevention of problems
	Manufacturing sites	• Enhanced labor productivity	• Passing on of skills, human resource training	• Greater safety and security

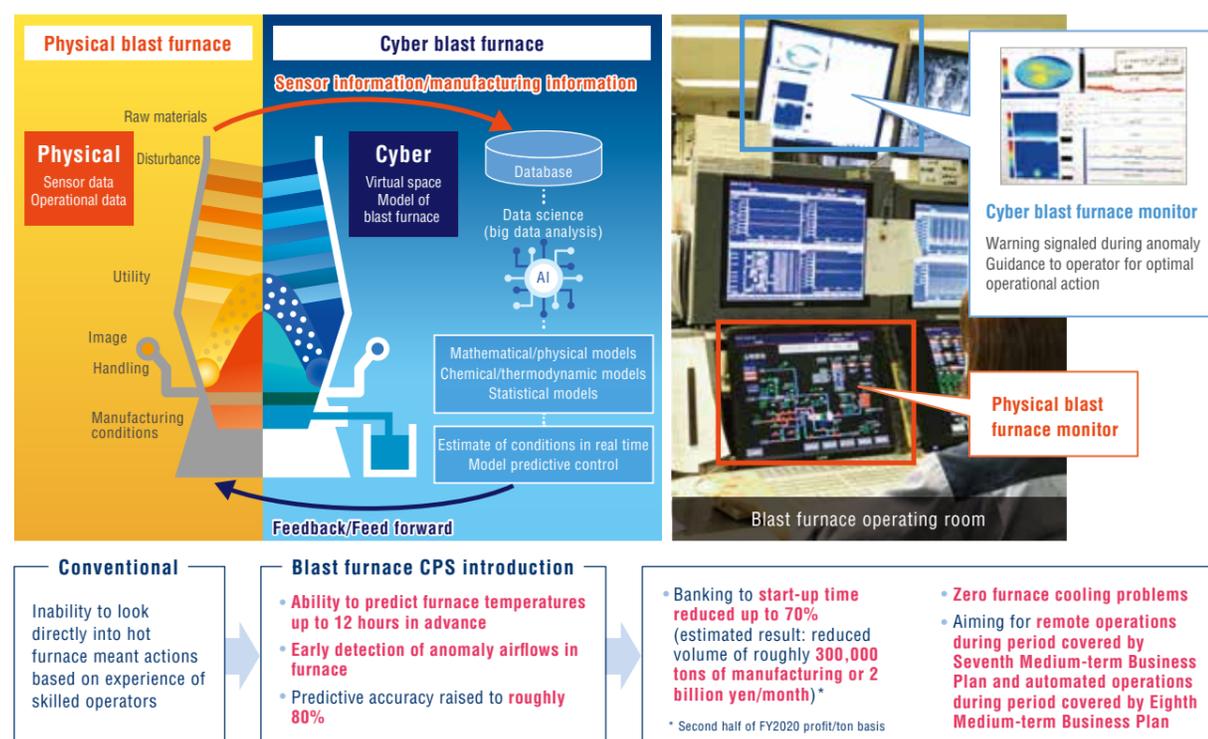
DX promotion road map

To achieve “intelligent steelworks,” we will complete the introduction of CPS for all steelmaking processes during the period covered by the Seventh Medium-term Business Plan, while also constructing an integrated CPS for each steelworks and JFE Steel as a whole. We will also pursue remote and automated operations, aiming to achieve even higher productivity and manufacturing stability.



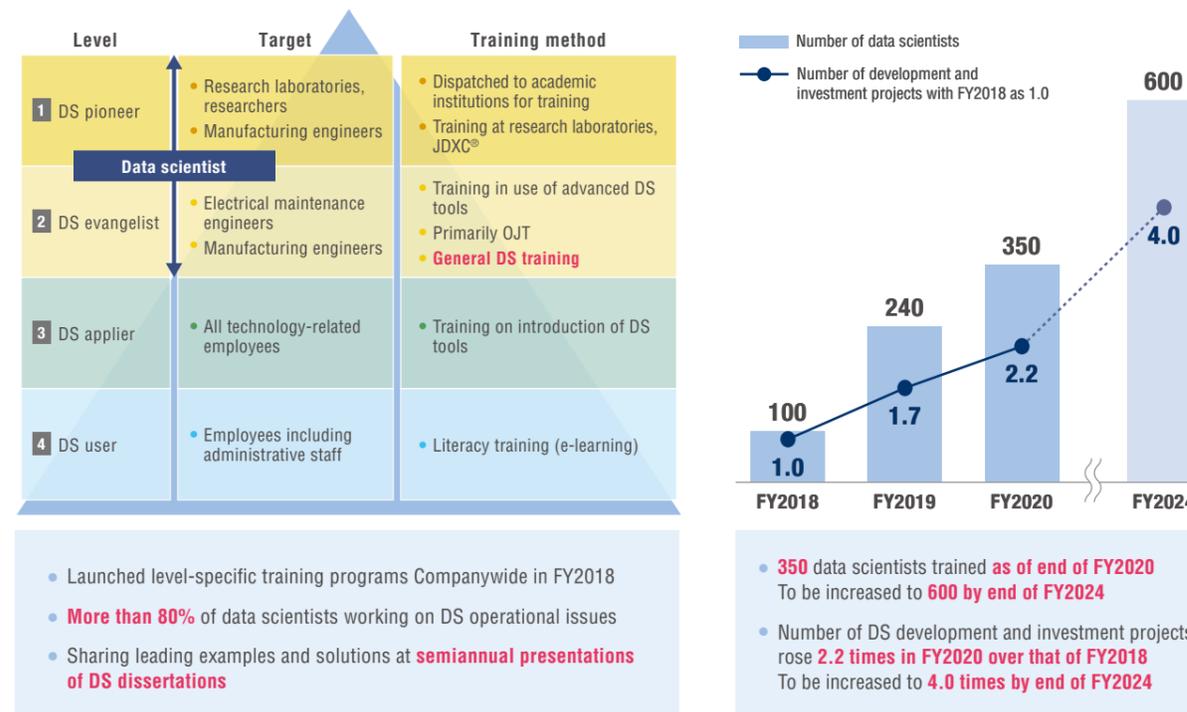
CPS example: Blast furnace CPS

We are introducing CPS at all blast furnaces and have developed and introduced technologies that can detect signs of anomalies that could lead to major problems inside a blast furnace, which previously were difficult to detect, and predict temperatures in a heated blast furnace up to 12 hours in advance, which is important for stable operations. We have also built a system that takes the results of those predictions to give guidance to operators for optimal action to take at that time, and are beginning to use those actions for stable operations and stable production.



DX human resource development: Training data scientists

For DX promotion, we are building easier-to-use environments and frameworks for utilizing data science to cultivate data scientists internally and encourage their activities, allowing many employees to take part in our DX promotion.



Activating DS utilization: Launching DS portal and creating DS tools and apps

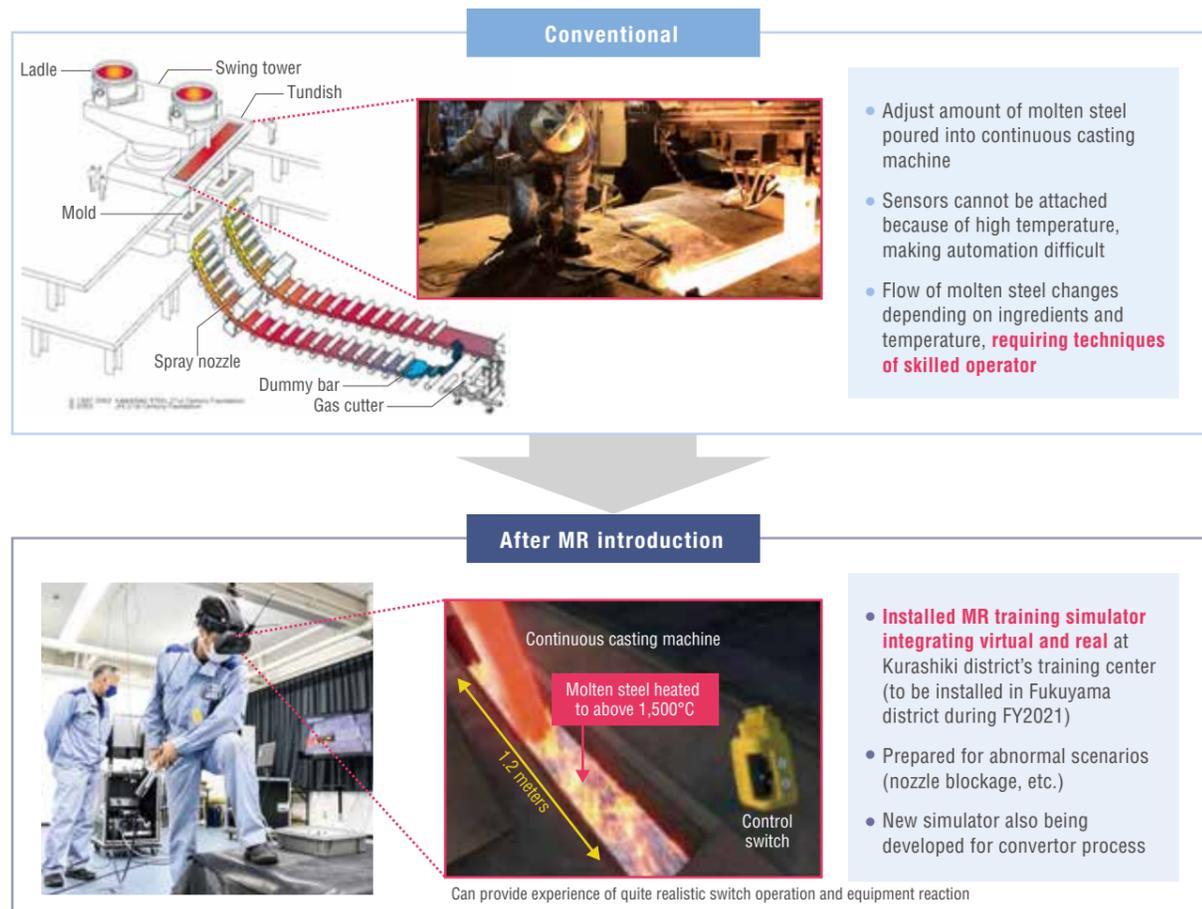
The JFE Steel Data Science Portal, a site that can be viewed by all employees that consolidates information about DS and robotics and the introduction and utilization of applications, was launched in March 2021 and is activating DS utilization.

All employees can upgrade and enhance the latest DS tools on their own personal computers at any time, and OJT is carried out by speakers from vendors and manufacturers who give presentations on workplace issues. Cases of implementation are steadily increasing, and sharing information via the DS portal is further activating DS application.



Using ICT to train human resources and pass on skills: Mixed reality (MR)

Operations that can be automated: Promoting introduction of robots to further increase labor productivity
 Operations that require human skills: Using latest technologies while safely and steadily passing on skills



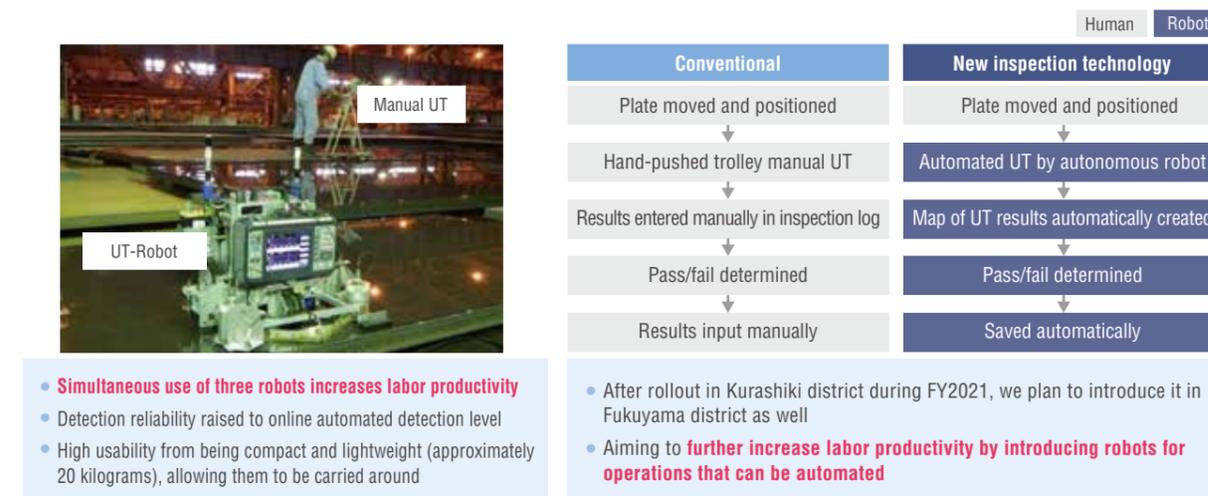
Using ICT for increased safety: Workplace safety monitoring and operational support

We pursue multifaceted safety management (monitoring, detection, etc.) that includes DX. We are developing various workplace operations and strengthening their functions through initiatives including using the latest information technology to increase workplace safety, using smartphones to oversee workplace operations, introducing systems to support remote operations, monitoring gas concentrations, and introducing measures to prevent accidents by installing sensors near heavy equipment.



Raising productivity through development and introduction of robots

We have developed the world's first autonomous Ultrasonic Testing Robots (UT-Robots) for inspecting steel plate and introduced an off-line testing process for steel plate using these robots. By automating manual testing operations we have achieved even higher levels of detection reliability and operational efficiency. Three of these robots have been introduced at a steel plate plant in the East Japan Works' Keihin district. Going forward, we intend to use these robots at steel plate plants at the West Japan Works (Kurashiki district, Fukuyama district), as we strive to further increase the quality of our steel plate while also making operations more efficient.



External service sales platform to support development of solutions business

We are exploring a "sales platform" to serve as a foundation supporting the solutions business being developed by the Global Business Development Division. This structure would use JFE's accumulated data to provide solutions to customers who conclude subscription contracts for the service. We are considering providing a "service portal" that takes into account customer convenience and secure connections with customers' systems, a cloud-based approach that would allow the portal to be used around the world.



- Building platform** that will be foundation of core new growth strategy of "solutions business"
- After completing construction during period covered by Seventh Medium-term Business Plan, **earnings from "solutions business" to be three times those of FY2020**
- Services provided by **subscription** via service portal **without disclosing core technologies**

JFE VOICE !

Pursuing robot development to automate plant operations and raise labor productivity

The Cyber-Physical System R&D Department's Robotics Group is working on the introduction of robots and automation based on mobility robot technologies. When we were developing the autonomous UT-Robots for inspecting steel plate, we frequently visited plants and talked with operators to address both technologies and plant operation. Going forward, we aim to increase added value at manufacturing sites by using DX to resolve issues in a variety of areas at manufacturing sites.

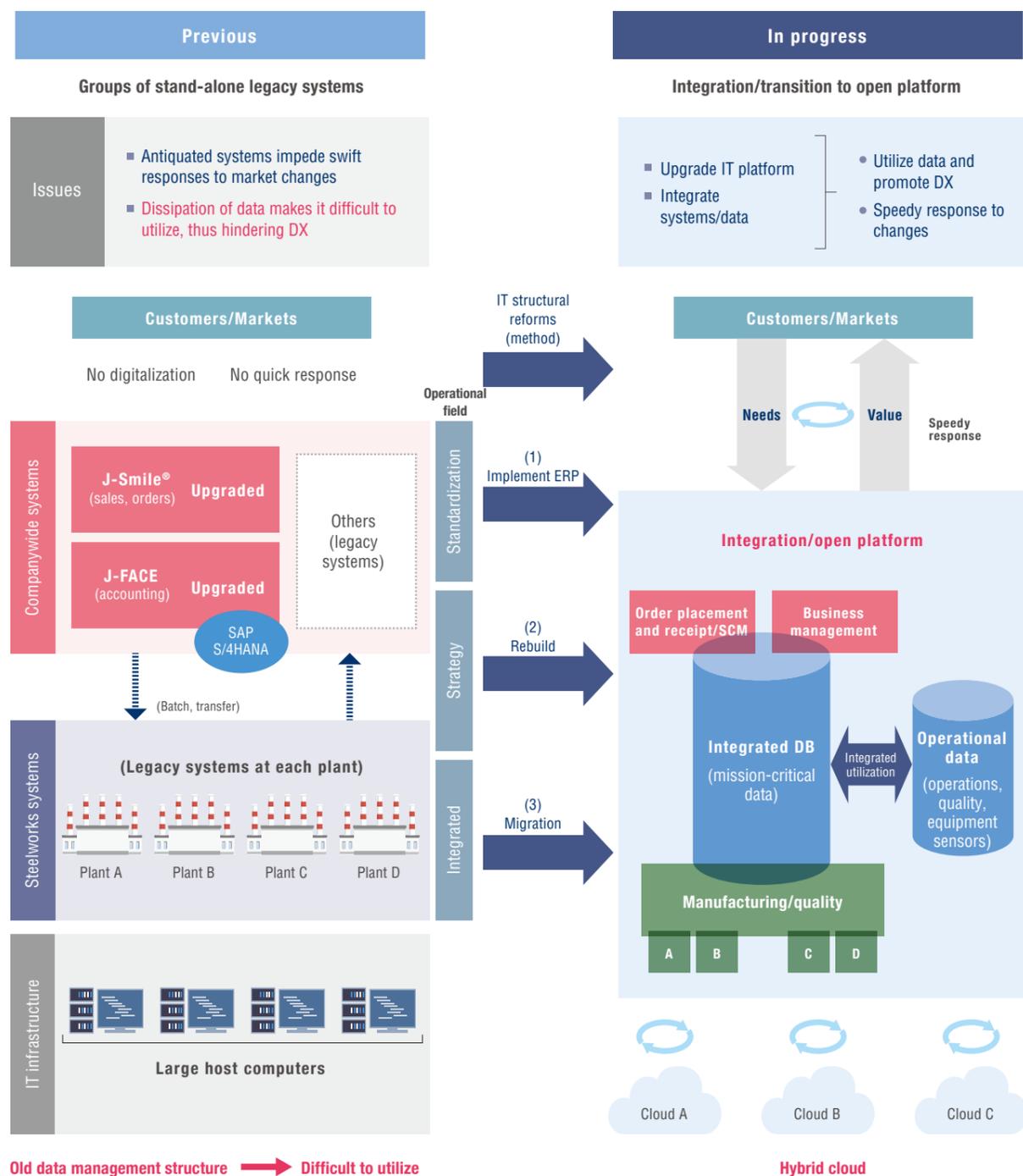
Masaki Kobayashi, Cyber-Physical System R&D Department, Steel Research Laboratory



Enhancing an information system platform for DX promotion

JFE Steel is restructuring its IT platform to be able to make use of the wealth of data assets that is the core of the DX strategy. By integrating legacy systems and converting to an open platform architecture, we are building a foundation from which to respond speedily and flexibly to environmental changes. Companywide mission-critical systems for sales and orders and accounting have already been upgraded, with the remainder to be standardized during the period of the Seventh Medium-term Business Plan, with approaches like enterprise resource planning (ERP) used in the migration. We are also pursuing mission-critical system updates at steelworks to achieve an IT structure that is highly flexible in responding to changes.

Upgrading legacy systems to build an IT platform that enables advanced use of data (= data-driven)



Project to convert head office mission-critical system to open platform

We expect to complete the transformation of all head office mission-critical systems, including the J-Smile® system for sales and orders, to an open platform architecture during fiscal 2021. Shifting to an IT platform with a high degree of expandability will make it possible to address business needs flexibly in the mission-critical operational areas of business management, purchasing, sales, manufacturing, and logistics.

Restructuring accounting-related systems by introducing ERP

We have completed the migration of the head office accounting system to an open platform architecture by introducing ERP. In addition to accounting, we have been working to install ERP packages in equipment planning and research and development systems to reform those operations. Using work-flow and electronic approvals to make operations paperless, we have contributed to work-style reforms through greater operational efficiency by automatically linking data that had previously been managed manually.

System updates at steelworks

By migrating steelworks' mission-critical systems to open platform, we aim to create new value and reform work styles with an operational platform that allows "all employees to share and use all information." Building on small successes beginning with the order receipt function at the Fukuyama district, we intend to have the system up and running at the Sendai Works during fiscal 2022 (the first entire steelworks to do so). We will then work to accelerate the process by rolling out to other projects the development process and expertise gained.

Head office	Steelworks					
	Kurashiki	Fukuyama	Chiba	Keihin	Sendai	Chita
Open platform project Sales, manufacturing, logistics	System updates at steelworks Manufacturing management, operational management					
Marketing Logistics	Upgrades scheduled for completion during periods covered by 7th and 8th Medium-term Business Plans					
Upgrade scheduled for completion during FY2021	Upgrades scheduled for completion during periods covered by 7th and 8th Medium-term Business Plans					
Open platform project Business management	Open platform project General administration					
Upgrade completed in 2021	Upgrades scheduled for completion during periods covered by 7th and 8th Medium-term Business Plans					

Open structure process

- Restructuring and migration
- ERP installation

JFE VOICE !

Contributing to new system launch at the Sendai Works and coordinating with manufacturing sites

The Sendai Works will launch its new system in fiscal 2022, the first for all production centers. Using the personal connections and expertise of the manufacturing management and operational technology divisions involved to date, we have helped align the new system with frontline manufacturing sites. We are moving forward toward the Sendai Works being fully integrated with a system for creating new value.

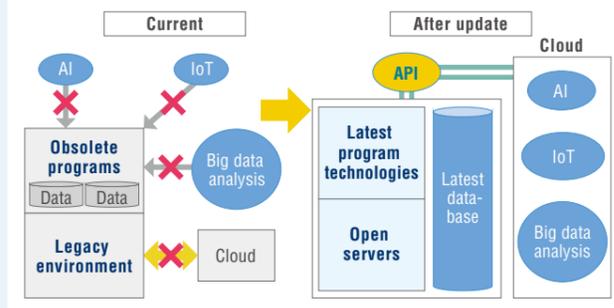


Fuminori Takeuchi, Tasuku Endo, Kengo Goto, Business Process Innovation Team

Sendai Works' system update

Migrating to open platform architecture by making maximum use of expertise and processes accumulated over time

Cloud-based IT platform → Advanced data use for DX propulsion → Operational improvement



Engineering Business

(JFE Engineering Corporation)



Atsushi Okamoto
Senior Managing Director

For achieving SDGs, “*Tsu-ku-ru*,” “*Ni-na-u*,” and “*Tsu-na-gu*” the foundations of life by promoting digital transformation (DX)

JFE Engineering has taken up the challenge of achieving SDGs (Sustainable Development Goals) through planning, designing, building, and operating infrastructure supporting people’s daily lives and industry.

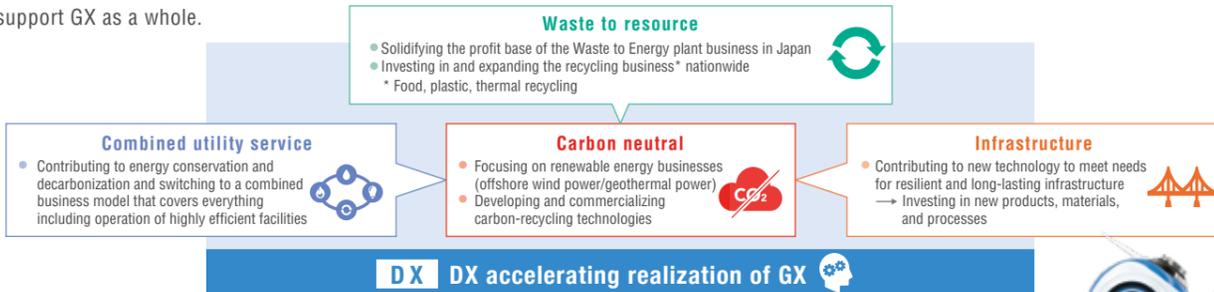
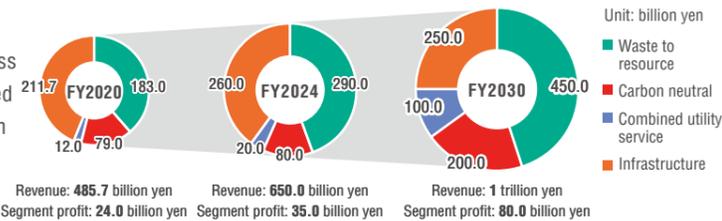
DX is necessary for our company to continue to be a front-runner in the engineering industry while further accelerating those initiatives.

We will go beyond simply increasing operational efficiency by proactively promoting digital transformation to achieve a green society and increase corporate value with initiatives including thoroughly reforming operational processes, adding new value to products and services, and taking up the challenge of using data for new businesses.

* “*Tsu-ku-ru*,” “*Ni-na-u*,” and “*Tsu-na-gu*” are Japanese words whose meanings for us are the following:
Tsu-ku-ru: Construction of plants.
Ni-na-u: Operating, maintaining, and managing business.
Tsu-na-gu: Handing over a beautiful planet to the next generations, good communication between our customers and us, throughout JFE, and construction of data networks, three elements essential for achieving SDGs.

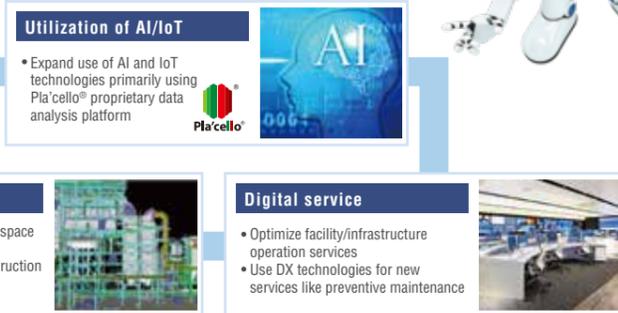
JFE Engineering’s Medium-term Business Plan

Aiming for fiscal 2030 revenue of 1 trillion yen, JFE Engineering has formulated a Seventh Medium-term Business Plan that focuses on four areas: waste to resource; combined utility service; infrastructure; and carbon neutral. Working in these four areas, we aim to create environmentally friendly social infrastructure and innovation that can be seen as a “green transformation (GX).” As we move forward, we are positioning “digital transformation (DX)” as the initiative to support GX as a whole.



JFE Engineering’s DX strategy

In addition to actively using the AI and IoT technologies pursued under the Sixth Medium-term Business Plan, under the Seventh Medium-term Business Plan we have added two core areas to our pursuit of DX: “digital twin” that reproduces the real world in a virtual space to visualize processes and costs and optimize operations; and “digital services” to transform businesses by providing optimal operation services for facilities and infrastructure and preventive maintenance services that use digital technologies.



Case 1: Reform business operations at construction and work sites by data linkage

Electronic tags/3D data linkage

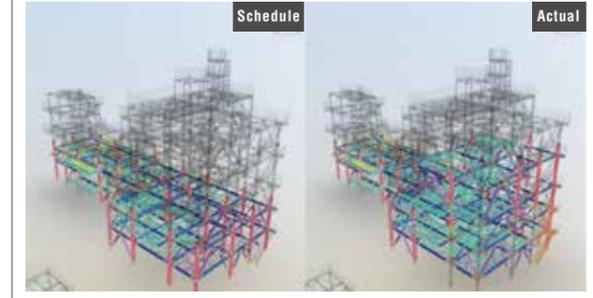


Electronic tags are attached to shipped items, and the electronic tag information is linked to 3D design data. The records of parts arrival management and construction progress are automatically obtained and used to track progress.

Actual construction date



Schedule/actual comparison



At construction sites, it is important to manage the arrival of parts and the progress of construction, but having on-site workers constantly inputting data creates a significant burden. JFE Engineering is therefore using electronic tags (RFID) to make on-site operations and management more efficient. Electronic tags are attached to parts shipped from steelworks and linked to 3D design data. An electronic tag reader is used on-site to manage the arrival of parts. As construction progresses, the electronic tag is removed when the part is attached, then simply put into a trash container equipped with a reader function. This process makes it possible to manage parts, construction, and progress without placing a burden on on-site workers.

JFE VOICE !



Front row, from left: Yamanaka, Hosoya, Yamamoto, Plant Construction Sector
 Back row, from left: Sugito, Horikawa, Imamoto, Horibe, ICT Center, Technology Headquarters

Significantly reducing work time by introducing electronic tags

By introducing electronic tags, we have made it possible to avoid parts sitting idle at manufacturing plants and manage deliveries at work sites by simply scanning while walking around the items placed at the work site. In addition, linkage with 3D data makes it possible to see the construction progress in real time from the head office. Some improvements are still needed, but we expect to make construction more efficient going forward.

Kei Yamanaka, Plant Construction Sector

Initiatives going forward: Business reform and operational optimization by using digital twin

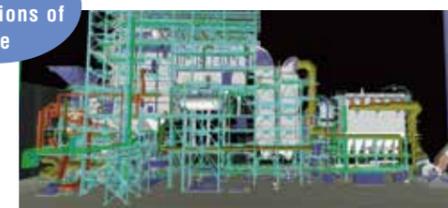
Engineering, Procurement, and Construction (EPC)

Process optimization | Cost visualization

Operation and Management (O&M)

Plant visualization | Optimal operation

“*Tsu-ku-ru*” foundations of life



To 4D (+ time) → Process optimization
 To 5D (+ expense) → Cost optimization

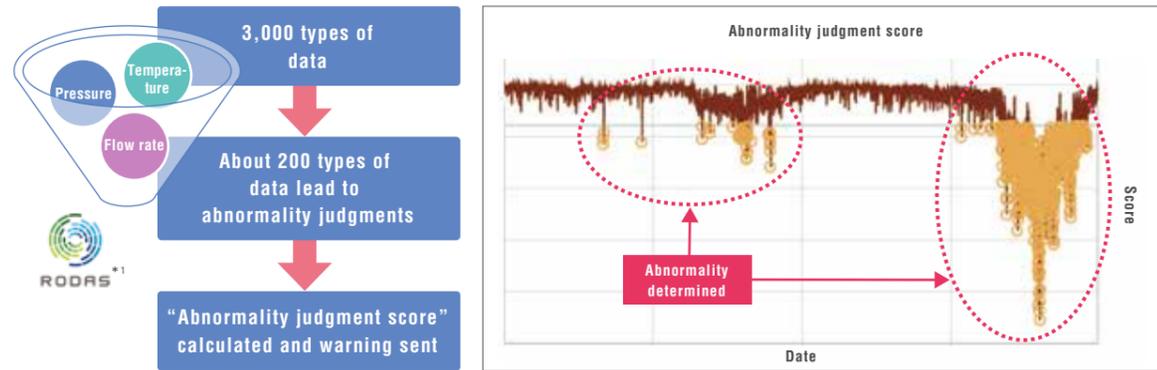
“*Ni-na-u*” foundations of life



Actual plant operations reproduced in virtual space

“Business reform using a digital twin” is at the core of JFE Engineering’s DX strategy. A digital twin is a “twin” of the real world constructed in a virtual space. A model of the real world is built using 3D data, IoT data, and other data from the plant and social infrastructure in the real world, and simulation analysis is carried out. Those results are fed back to the real world and used to optimize operations and make them more efficient. The development and implementation are being carried out in two parts: “digital twin (‘*Tsu-ku-ru*’)” that aims to make operations more efficient and visualize projects in the engineering, procurement, and construction (EPC) process, and “digital twin (‘*Ni-na-u*’)” that aims for optimal automated operation and plant visualization in the operation and management (O&M) process.

Case 2: Detecting signs of operational failure at biomass energy plants



Biomass power generation seeks to achieve high output with stable, efficient power generation regardless of fuel quality. Early detection of potential failures is important for stable operation, but to date this has relied on operators' skill and experience. The AI-based operation support system is able to extract, from a huge amount of operational data that humans cannot process unaided, information that could indicate imminent operational failures and reduced power generation efficiency. The system analyzes data in real time and visualizes it as an "abnormality judgment score," which reduces monitoring work and detects abnormality in advance. We continue to collect more operational data and expand functions with the aim of superior plant operation with even greater stability and efficiency.

JFE VOICE !



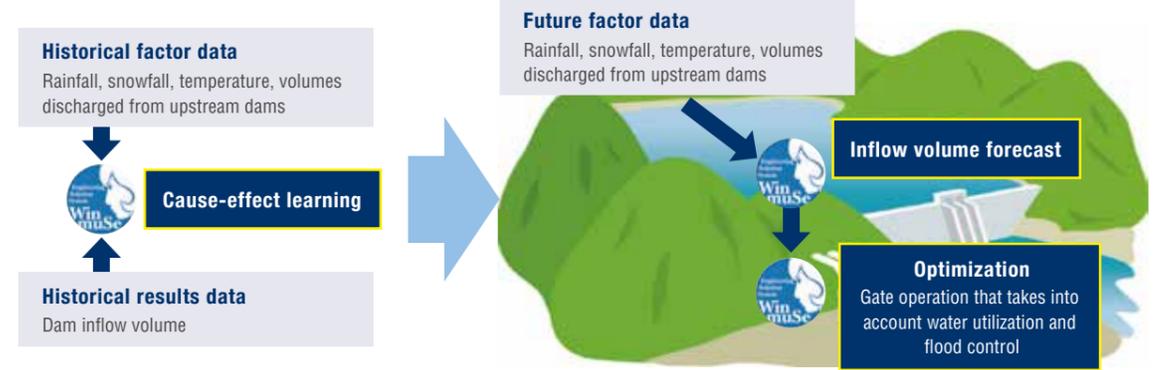
From left: Habiro, Electrical & Control System Center, and Yoshioka, ICT Center, Technology Headquarters

Using Pla'cello® for advance detection of operational failure

The Pla'cello® abnormality warning detection system and visualization and analytical tools make possible the early detection of signs of abnormalities, the swift assessment of the situation, and the timely investigation of the cause. The capability to detect early any critical abnormalities that could lead to an emergency plant shutdown is useful for stable operation.

Yoshiaki Habiro, Power Plant Engineering Department, Electrical & Control System Center

Case 3: Dam Optimal Operation System



JFE Engineering and Hokuriku Electric Power Company are jointly developing the Dam Optimal Operation System with the aim of increasing the amount of hydroelectric power generated. A verification test conducted at a dam in fiscal 2020 confirmed the system's ability to predict with high accuracy the amount of water that will flow into the dam. The test also confirmed that reflecting and optimizing the predictive data in the dam's operation could be expected to increase the amount of hydroelectric energy generated (approximately 5,000 MWh annually). In addition to increasing the number of dams where this system is used, the two companies are working to improve and develop the system further by incorporating the latest AI technologies to increase significantly the amount of CO₂ emission-free hydroelectric power.

JFE VOICE !



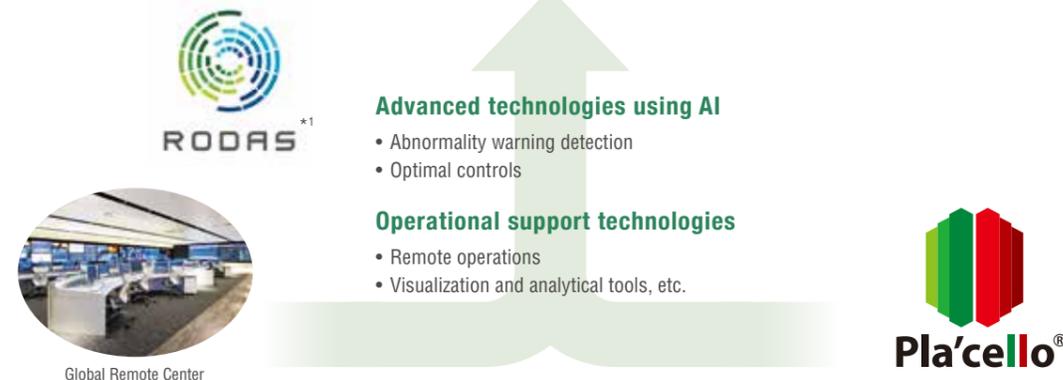
From right: Takago, Hokuriku Electric Power Company, and Hadama, ICT Center, Technology Headquarters

Meeting customers' requirements with reliable AI solutions

Hydroelectric power is one of our company's main power sources. Increasing the accuracy of dam inflow volume predictions is crucial to increasing the amount of hydroelectric power generated. Through this joint development, our two companies are working to make the system more robust and increase the possibilities for hydroelectric power generation.

Ryuei Takago, Civil Engineering Management Team, Renewable Power Department, Hokuriku Electric Power Company

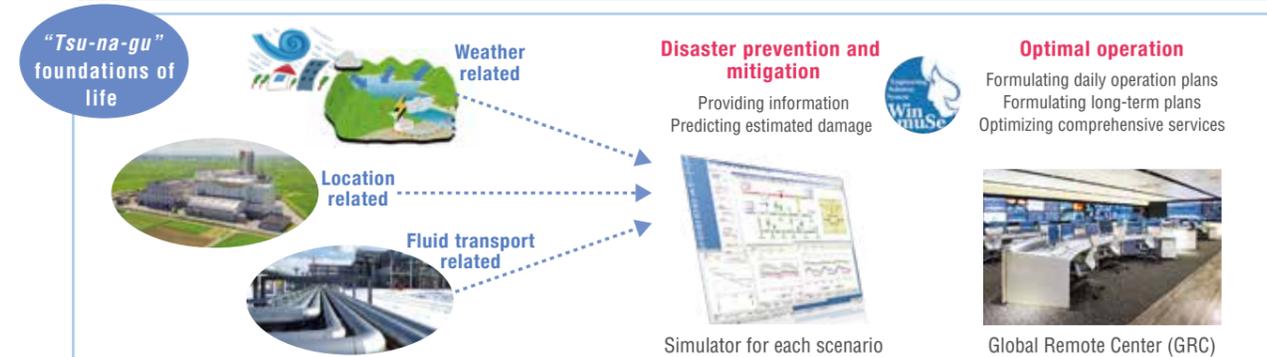
Initiatives going forward: Providing preventive maintenance management services for boiler power plants



We have begun offering RODAS, a package of technologies using big data that we developed for biomass energy plants and other boiler power plants. This is one of the first initiatives in the plant industry globally to provide comprehensive DX-related services for boiler power plants using artificial intelligence and cloud technologies. RODAS, which was realized through the accumulation of big data, features an abnormality warning detection function and optimal control technologies using artificial intelligence. Efficient operation with artificial intelligence makes it possible to maintain stable operations despite a shortage of skilled engineers, thereby increasing customers' profits as well. Going forward, we will pursue even more advanced plant operation technologies based on Pla'cello® to contribute to promoting DX in the plant industry and increase the use of renewable energy.

*1 RODAS: A service package of technologies that uses big data for boiler power plants. Trademark registration pending.

Initiatives going forward: Service of providing information about disaster prevention and mitigation to social infrastructure operators



JFE Engineering is using our proprietary WinmuSe® AI engine, with strengths in predictive AI based on various weather-related data (to forecast demand, water levels, etc.), and optimization AI using information collected from plants to supply various services to local governments and social infrastructure operators. Important social infrastructure facilities for water supply, sewerage, and city gas, which are indispensable for people's daily lives, must provide stable, uninterrupted service. In addition to normal times, providing service when disasters strike requires the preparation of appropriate facility operation plans that anticipate disasters and regular drills.

Going forward, we will construct a high-speed simulator that accurately reproduces operation processes to provide service to support disaster responses at important facilities.

Trading Business

(JFE Shoji Corporation)



Tatsuya Sakamoto
Managing Executive Officer

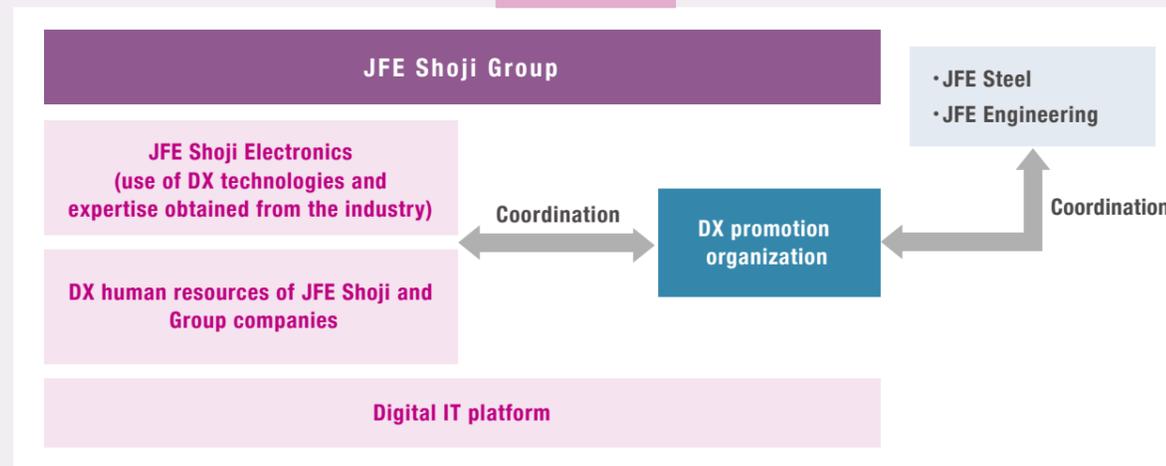
Under the Seventh Medium-term Business Plan (FY2021–FY2024), the JFE Shoji Group is pursuing a DX strategy that is investing for growth over 10 years in the three areas of “innovative productivity enhancement,” “transforming existing businesses,” and “creating new businesses using digital technologies.”

During fiscal 2021, we established an internal DX propulsion working group that has begun to consider DX solutions Groupwide. We are also conducting DX training to deepen each employee’s understanding of DX while collecting ideas for using DX in businesses and workplaces and putting those ideas to specific uses.

The JFE Shoji Group will continue to use DX to increase satisfaction among both customers and employees.

Vision for DX promotion

Continuous creation of corporate value and enhanced competitiveness by providing DX groundbreaking services



Non-destructive inspection using radar-equipped drones

JFE Shoji Electronics and Osaka University have jointly developed a non-destructive system for remote inspection inside various structures using drones equipped with ultrawide band (1G–1,000 GHz) radar.

Phase detection using different radar wavelengths corresponding to various structures being inspected allows for assessment of a structure’s condition with contactless, non-destructive diagnosis and visualization of risks the naked eye cannot see.

The system is still at the demonstration testing stage but when implemented is seen being used over a wide range including plants, construction and infrastructure, primarily for equipment in old buildings, high locations, and other places where it is difficult for humans to conduct maintenance and inspection. It can also be expected to contribute to resolving the social issues of inspection, repair costs, and personnel shortages, and to increasing efficiency and safety.

Non-destructive inspection using ultrawide band (1G–1,000 GHz) radar-equipped drones

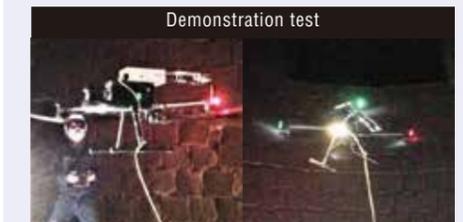


Target for non-destructive inspection

Target	Range	Effects, functions, capabilities	Area
Concrete	Microwave	Visualization of internal structure of concrete, fire-resistant, castable materials, etc.	Bridges and buildings, social infrastructure, smokestacks, plant equipment, etc.
Underground, in snow	Milliwave Microwave	Trace inspections of underground objects	Underground objects, objects covered by snow Embankments, energy infrastructure, etc.
Instability	Microwave	Detection of loose or strained bolts	Steel towers, roads, signs Infrastructure inspection (external)
Coatings and defects	THz wave	Inspection of quality, defects, etc., of coatings	Ships, buildings and structures, metal-plated surfaces

Successful demonstration test of inspection of smokestack's inner coating thickness

For work previously done with the naked eye or a camera viewing a surface, this approach will make it possible to assess effectively the thickness of an inner wall without causing damage, while also allowing early detection of the degree of wear and tear inside a smokestack.



Promoting RPA

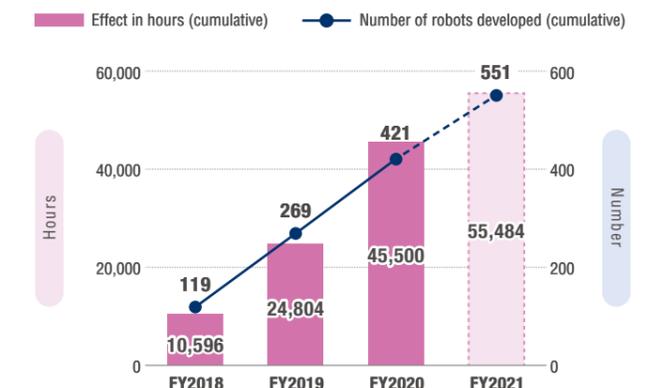
The development of robots for Robotics Process Automation (RPA) began in fiscal 2018, and Companywide needs were identified as of the end of fiscal 2021. The roughly 550 robots that have been developed are expected to achieve laborsaving reductions of approximately 56,000 hours annually. We are also developing replacement robots in response to environmental changes. In addition to increasing the efficiency of existing operations, we have recently been using AI-OCR* to digitalize some documentation and adding functions to robots for customer service. We are also accelerating their introduction to Group companies. Going forward, we will work to establish a “new normal” of an “operational style in cooperation with robots.”

* OCR: Optical Character Recognition/Reader

JFE Shoji Group's utilization of RPA robots (fiscal 2021 year-end projections)

	JFE Shoji	JFE Shoji Group companies
Number of robots operating	Roughly 550 robots operating (end of FY2021) ➔ Maintain high level	Roughly 145 robots operating (end of FY2021) ➔ Increase
	<ul style="list-style-type: none"> Hours of labor savings: Average of approximately 100 hours/year/robot Robots/section: Average of 5.1 robots/year Breakdown: Marketing 83%; Administration 17% 	<ul style="list-style-type: none"> Companies: nine Special feature (1): Developed by referencing JFE Shoji's existing robots Special feature (2): Standardization of head office-use robots for use at branch offices

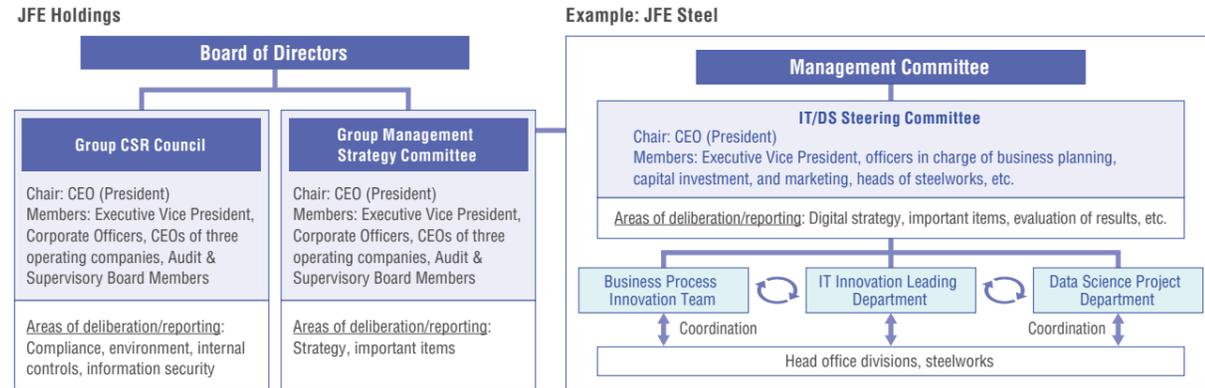
Number of robots developed and labor savings by year at JFE Shoji



Digital governance

JFE Group digital governance framework

Group digital governance structure is embedded in the corporate governance framework



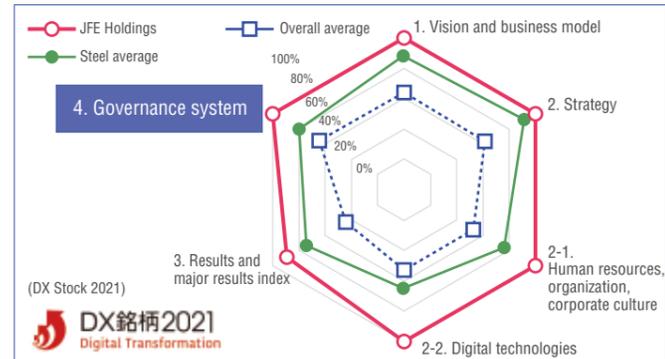
Designation standards and JFE's position under DX certification structure (Ministry of Economy, Trade and Industry)

Designated as a **DX-certified operator** in recognition of ongoing management leadership based on digital governance
Selected as a **DX stock (Competitive IT Strategy Company)** for seven consecutive years

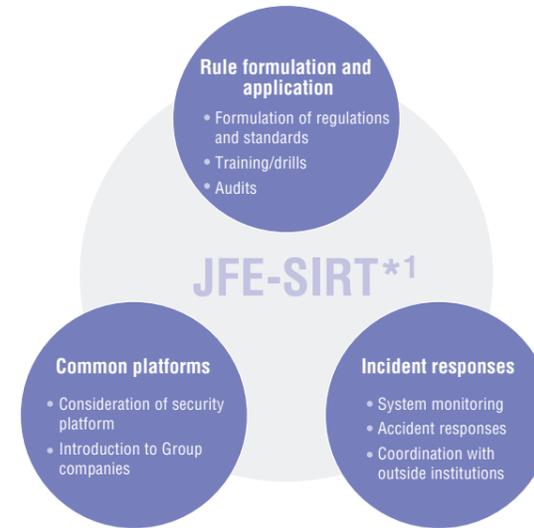
Standards for DX-certified operator designation

1. Management vision and business model
2. Strategy
 - 2-1. Organization, structures, etc., for realization of strategy
 - 2-2. Use of digital technologies for realization of strategy
3. Results and major results index
4. Governance system

Evaluation of JFE Holdings' digital governance by DX Stock Evaluation Committee

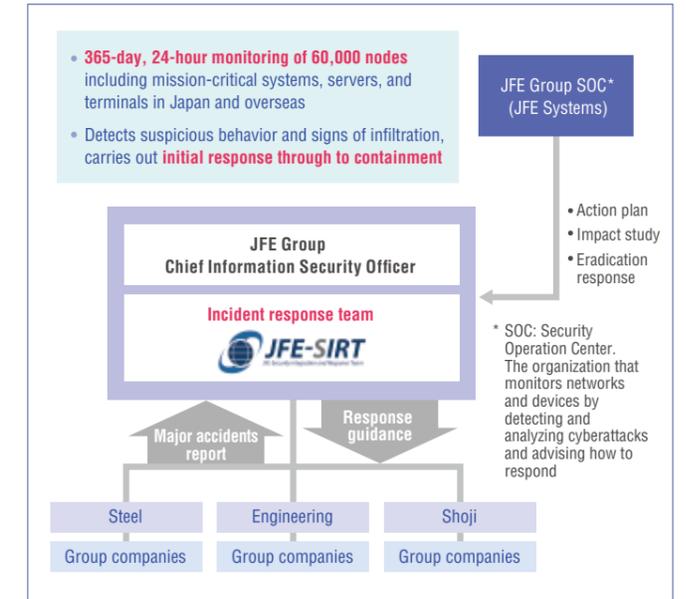


Cybersecurity monitoring initiatives



*1 JFE-SIRT: A CSIRT*2 responsible for responding to incidents of information security, as well as planning, proposing, and promoting Groupwide measures, auditing Group companies, and reviewing security policy
*2 CSIRT: Computer Security Incident Response Team. A general term for a group that responds to internal computer security-related incidents

System monitoring overview



Message from JFE-SIRT

We again had numerous reports of damage from cyberattacks and hacks during 2021. In addition to cases overseas that led to pipelines coming to a halt and affecting social and economic activity, many cases in Japan forced companies to cease operations.

Today, networks and the Internet in particular are indispensable tools and infrastructure for social and economic activity. At the same time, information can be stolen if those tools are breached, and some organizations use them as weapons to disrupt society.

We recognize that we face dangers and that DX and cybersecurity are two sides of the same coin, and we will work to strengthen our people, organization, and technologies.



Ken Sakata
Team Leader, JFE-SIRT

Initiatives being strengthened further

Initiatives going forward



In addition to initiatives at each operating company and the Group's security countermeasures, **specific Groupwide themes will be considered going forward.**

Proposed themes for consideration	Details
• Construction of a CO ₂ emissions management system	<ul style="list-style-type: none"> • Timely and efficient emissions management • Use of data analysis to reduce emissions
• DX in the logistics supply chain	<ul style="list-style-type: none"> • Integrated linkage of manufacturing, sales, and logistics information • Enhanced CS and efficiency with lower logistics costs and CO₂ reductions

Security management

JFE Group security management structure

In line with the Declaration of Cybersecurity Management, we are **strengthening our management-led cybersecurity countermeasures**, primarily at **JFE-SIRT**, in response to increasingly serious and sophisticated cyberthreats.

Declaration of Cybersecurity Management

1. Recognize cybersecurity as a management issue
2. Determine management policies and declare intentions
3. Build internal and external systems and implement security measures
4. Encourage widespread use of cybersafe products, systems, and services
5. Help build safe and secure ecosystems

JFE Group security governance structure



Named DX Stock 2021*1

For seven consecutive years, JFE Holdings has been designated as a company proactively pursuing DX, and JFE Holdings has been selected by the Ministry of Economy, Trade and Industry (METI) and the Tokyo Stock Exchange (TSE) for inclusion in the Competitive IT Strategy Company Stock Selection, renamed the Digital Transformation (DX) Stock Selection in 2020.

During fiscal 2018 through fiscal 2020, the period covered by the Sixth Medium-term Business Plan, our proactive pursuit of DX yielded results that led to a transformation of the business model to incorporate the use of DX, and the Engineering Business's advanced use of DX has also been recognized externally.

From fiscal 2021 through fiscal 2024, under the Seventh Medium-term Business Plan, we will pursue DX further, making maximum use of the wealth of data, expertise, and technologies we have accumulated to date, leading to greater earnings strength, the realization of our growth strategy, and a more sophisticated business model.

*1 JFE Holdings corporate website (News Release section) (in Japanese only)
<https://www.jfe-holdings.co.jp/release/2021/06/210608.html>



Briefing on the JFE Group DX strategy*2

JFE Holdings held a briefing on our DX strategy for the mass media, securities analysts, and institutional investors on August 26, 2021. The briefing was held online and simultaneously streamed from two locations: JFE Steel's JFE Digital Transformation Center (JDXC®), a base for DX promotion, and JFE Engineering's Global Remote Center (GRC), a remote monitoring and operational support center for plants.

The briefing, the first on DX for the JFE Group, included explanations of the JFE Group's DX strategy and the strategies and specific initiatives being carried out at each operating company. DX is an important strategy for the JFE Group, and we will continue to work to promote a better understanding of our DX efforts.

*2 JFE Holdings corporate website (News Release section) (in Japanese only)
<https://www.jfe-holdings.co.jp/investor/management/plan/index.html#20210826>



JFE Steel's JDXC®, a base for DX promotion



JFE Engineering's GRC, a remote monitoring and operational support center for plants

JFE Group Declaration of Cybersecurity Management

1 Recognize cybersecurity as a management issue

The JFE Group recognizes cyber-related risk as a key management priority. We shall enhance our own understanding of the latest cybersecurity developments and actively engage in management by positioning cybersecurity spending as an investment.

Management shall enhance their cybersecurity measures with responsibility while confronting realities, addressing risks, and exercising leadership. Members of management shall chair cybersecurity-related committees at JFE Holdings and its three operating companies, promote constructive discussions, validate various measures, and allocate appropriate resources to whatever measures deemed necessary.

2 Determine management policies and declare intentions

The JFE Group shall determine management policies and draft a business continuity plan (BCP) aimed at quick recovery in the event of a cybersecurity incident, emphasizing not only identification and defense, but also detection, response, and recovery.

Every year, the JFE Group shall lay out a cybersecurity action plan for the Group, reflecting a review of risk identification, defense mechanisms, and guidelines for responding to an information security incident. Also, the JFE Group shall strengthen incident response capabilities through regular drills and prepare the BCP. Furthermore, the JFE Group shall periodically conduct cybersecurity audits on JFE Group companies. Through these efforts, the JFE Group aims to steadily raise the level of the overall Group.

Management shall take the lead in declaring companies' intentions to internal and external stakeholders, and make every effort to voluntarily disclose recognized risks and measures to deal with them, in corporate reporting.

3 Build internal and external systems and implement security measures

The JFE Group shall establish internal systems mainly through JFE-SIRT, ensure sufficient resources including budgets and personnel, and take necessary human, technical, and physical measures.

Using various internal and external human resources development programs, the JFE Group shall cultivate the skills of high-level, professional staff with detailed knowledge of cybersecurity and shall work with external specialists to leverage the benefits of sharing know-how. The JFE Group shall strive to educate and motivate employees at every level in all divisions at each company under the JFE Group umbrella through in-house training and drills, as well as participation in cross-industry exercises.

The JFE Group shall manage cybersecurity throughout domestic and international supply chains by monitoring security measures at outsourcing contractors and others on the supply chain.

4 Encourage widespread use of cybersafe products, systems, and services

The JFE Group shall manage cybersecurity across the full spectrum of corporate activity, including development, design, production, and supply of products, systems, and services.

5 Help build safe and secure ecosystems

The JFE Group shall collaborate with relevant government agencies, organizations, industry associations, and other bodies to actively share information, engage in dialogue, and build human networks, both in Japan and internationally. The JFE Group shall contribute to reinforcement of cybersecurity throughout global society by raising awareness of measures taken on the basis of such information.



JFE

JFE Group

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