

JFE Steel's DX Promotion Vision

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Abstract:

JFE Steel has been promoting digital transformation (hereinafter, DX) by actively using data and digital technologies to improve productivity and enhance competitiveness. As the business environment continues to change at an accelerating pace, not only data utilization and operational improvements, but also breakthrough innovations in process technology and a revamped business model have become necessary in recent years, making DX one of the most important elements of management strategy. This article describes JFE Steel's DX promotion vision and DX initiatives, which are positioned as one of the key strategies in the 7th Medium-Term Management Plan.

1. Introduction

Rapid and sweeping changes are underway in the current social and economic situation. Intensifying global competition due to the rise of China, global economic uncertainty and increased geopolitical risks due to the confrontation between the United States and China, effort to address climate change such as carbon neutrality, the development of innovative digital technologies, and the spread of the novel coronavirus have created an extremely difficult business environment which the world has never experienced before. In order to establish a strong management base for sustainable growth in this environment, the JFE Group formulated the 7th Medium-Term Management Plan (hereinafter, 7th Mid-Term Plan) covering the period from FY 2021 to FY 2024. This period is considered to be the largest period of change since the founding of the JFE Group, and its DX strategy is positioned as one of the key strategies that will determine success or failure in responding to these changes.

Based on the JFE Group's DX strategy and the 7th Mid-Term Plan, JFE Steel is also planning a DX strategy to gain competitive advantage. In September 2018, Japan's Ministry of Economy, Trade and Industry (METI) released its "Report on Digital Transforma-

tion: Overcoming of '2025 Digital Cliff' Involving IT Systems and Full-fledged Development of Efforts for Digital Transformation", and raised an alarm about the management and security risks posed by the existing antiquated systems, which have become complicated and black-boxed. To avoid these problems, JFE Steel has identified building a flexible and secure IT platform, revamping legacy systems, and standardizing business processes as key issues.

Based on the background outlined above, this article outlines JFE Steel's DX promotion vision and describes its DX strategy in the 7th Mid-Term Plan, taking up actual initiatives.

2. JFE Steel's DX Promotion Vision

The JFE Group considers its accumulated wealth of data, expertise, and technology to be a source of competitiveness for realizing business transformation and creating new value-added products and services by making the most of these assets based on state-of-the-art ICT and digital infrastructure, and for ensuring that the risks of environmental change lead to opportunities for growth.

Similarly, at JFE Steel, the main focus of the DX strategy is "sophistication of data use." JFE Steel has a longer history of manufacturing than steel companies in other countries, and its various types of data are invaluable. The company's accumulated expertise in high-grade steel manufacturing, measures for aging equipment, and data related to predictive management (anomaly prediction/signs) are the sources of our competitiveness, as we make advanced use of these data as one of JFE Steel's important strategies.

Figure 1 shows an overview of JFE Steel's DX strategy. JFE Steel's vision is to be "a global steel supplier that always creates new value and grows with customers," and the DX promotion policy to realize this vision is, as mentioned above, the largest asset of JFE Steel for "gaining competitive advantage through the proactive utilization of data (data-driven)." We have defined

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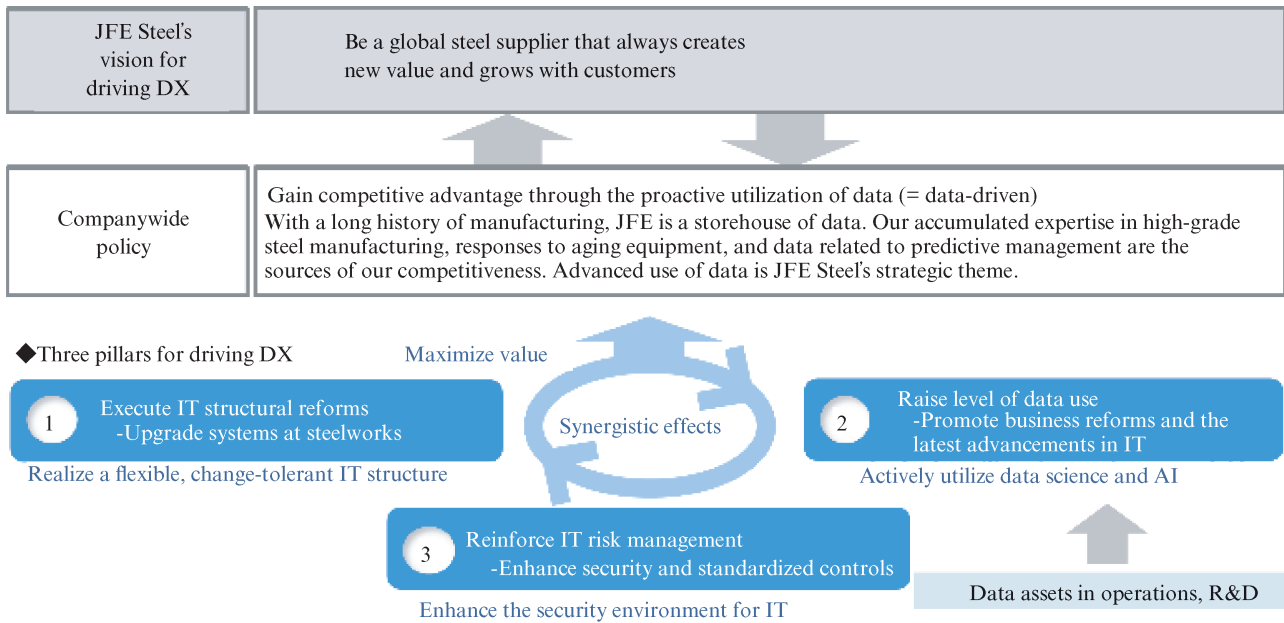


Fig. 1 JFE Steel's DX strategy overview

three pillars to support the promotion of DX, and aim to maximize value through the synergy among them. These three pillars are introduced below.

2.1 Execute IT Structural Reforms

Until now, JFE Steel has operated its core systems in a legacy environment, which is characterized by high reliability and other features, considering the serious effects if an abnormality occurs. On the other hand, because legacy environments are built based on the standards of each manufacturer, there have been challenges in utilizing data assets, such as the lack of system configuration options and functional scalability, which make it difficult to utilize advanced digital technologies.

Therefore, the first pillar supporting the promotion

of DX is “IT structural reforms,” which means building an open platform to realize a “flexible, change-tolerant IT structure,” and integrating and migrating aging legacy systems to that platform. **Figure 2** shows an image of this effort. As shown in the center of Fig. 2, there are three ways to move to an open platform, and the transition is made by these respective methods, depending on the characteristics of the area:

- (1) ERP (Enterprise Resources Planning), which is applied to areas that can be standardized, such as management-related systems.
- (2) Restructuring of systems in strategic areas after reviewing and redefining business processes.
- (3) Migration of areas that have already been consolidated.

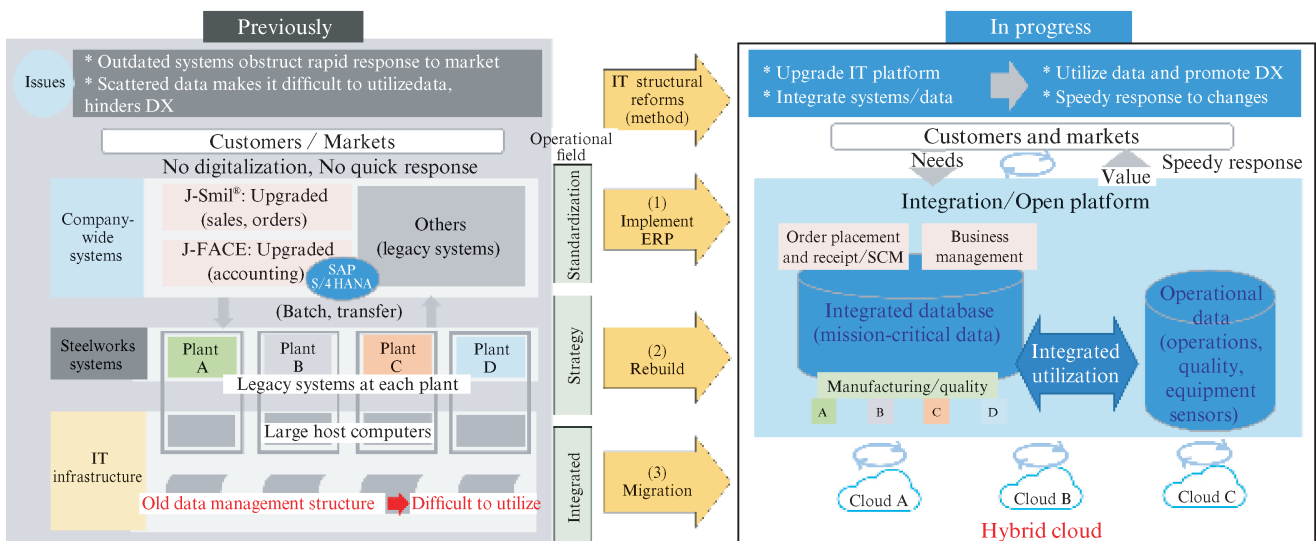


Fig. 2 Development of IT system infrastructure to promote DX

2.1.1 Building system infrastructure to promote DX

Based on its “cloud first” policy, JFE Steel constructed a new platform, the J-OS cloud, which is a dedicated internal private cloud and has been in operation since April 2016. The J-OS cloud provides an environment for the operation of internal core systems and data storage and is available from all JFE Steel sites. A hybrid cloud environment was also built, making it possible to utilize advanced digital technologies on the public cloud while ensuring safe security by connecting this environment to the public cloud via an API (Application Programming Interface). The core systems will be gradually transferred to this environment, and an open environment will be implemented in the entire company during the period of the 8th Mid-Term Plan. Moving to a highly scalable open platform will make it possible to respond more quickly and flexibly to customer needs and changes in the business environment than in the past, and integration of the company’s IT platforms will enable comprehensive utilization of scattered data, which can be combined with advanced technologies such as AI, IoT, and big data analysis.

2.1.2 ERP strategy

In the Head Office, the transition to an open platform was advanced by ERP in the accounting area and by migration in integrated areas including “J-SmileTM”²⁾, and full opening of all of the company’s core systems was achieved in FY 2021. However, there are still parts of the business management area of the Head Office where simplification and standardization of business processes are needed, and expanded use of ERP is being studied for this purpose. JFE Steel’s approach to ERP is shown in **Figure 3**. The horizontal axis shows the nature of the business process, classified by whether the process is highly unique and leads to differentiation or is a core area that requires standardization. The vertical axis is the IT perspective, and is

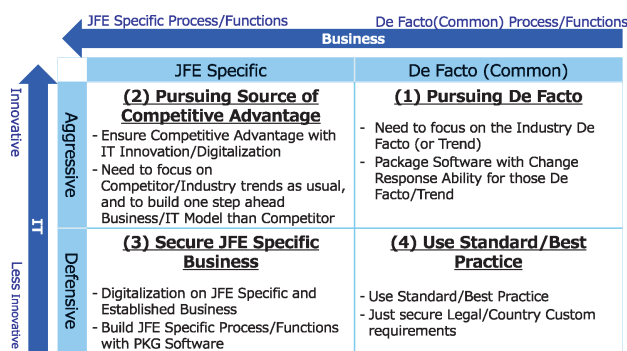


Fig. 3 JFE Steel’s ERP applying model/plan from business/IT perspective

classified by whether it is an “Aggressive” area characterized by a high degree of innovation or, on the contrary, a “Defensive” area with less innovation. We mapped operations into four quadrants on these two axes and examined ERP application strategies, as described in the following.

The first step in application of ERP in JFE Steel was the area in the fourth quadrant. In areas where there is little change and standardization of business processes is necessary, an ERP package, which is the de facto standard, is applied. As an example, the financial accounting area may be mentioned. In FY 2017, we introduced an ERP package in the Group’s common accounting system and achieved standardization of accounting operations for 81 JFE Group companies and adoption of IFRS (International Financial Reporting Standards). Simplification and efficiency of work were realized by constructing new work and new systems, making the most of the characteristics of the package, instead of reproducing the current work by add-ons and customizations. As a result, the system renovation was completed in a short time of nine months.

The second step was in the third quadrant. In areas where company-specific business processes are important, while changes are few, JFE aims to differentiate itself by adding unique processes and functions to the package. One example of this is the capital investment area. In FY 2020, the integrated renovation of 3 systems (facility planning, facility construction, research and development) related to capital investment was completed. These systems were moved from the host computer or aging client-server infrastructure, respectively, to the same common infrastructure in the cloud as the accounting domain, where introduction of ERP has already been completed. Placing these systems on a common platform enabled quick data linkage, and labor-saving and paperless operations were achieved by standardizing personalized operations and digitizing workflows.

Based on these cases, we aim to apply ERP to the first quadrant area as the third step from the 7th Mid-Term Plan in order to realize flexible and standardized business processes by applying the de facto standard package, which can respond to rapid environmental changes. The areas considered for application are the purchasing and personnel areas.

In JFE Steel’s business management domain, there are remaining areas where a rapid response to environmental changes and simplification and standardization of increasingly complex and proprietary business processes are needed. We will continue to promote system renewal while including application of ERP as an option.

2.1.3 Upgrading of systems at steel works

The core systems of JFE Steel's steel works will also be shifted from the legacy system infrastructure built for each site to an open platform unified at the company-wide level in accordance with the policy of "IT structural reforms" so as to integrate and transfer aging legacy systems. In the transition, operations will be standardized by reviewing and redefining business processes, and in addition to unifying the platform, a business infrastructure that enables all employees to share and utilize company-wide data will be realized as a foundation for creating new value.

2.2 Higher level of data use

The second pillar is sophistication of the level of data use. During the period of the 6th Mid-Term Plan from FY 2018 to FY 2020, we promoted advanced utilization of data that was different from the conventional system, such as introduction of the control failure recovery support system J-mAster™, which makes it possible to utilize data accumulated in the company-wide integrated maintenance system on the J-OS cloud via IBM™ Watson (question answering and decision support system provided by IBM Japan, Inc.) on the public cloud and retrieve actions to be taken in the event of a control failure from the past data for all production lines. In the future, we will continue to promote advanced utilization of data collected in facilities, processes and operations, aiming to realize an "Intelligent Steelworks" (steel works that learn by themselves and carry out optimal learning autonomously).

In promoting DX, it is also necessary for each employee in charge of practical operations to possess knowledge and skills related to digital technology, and from this viewpoint, JFE Steel also considers "reskilling" of employees to be important. Since advanced use of data requires not only systems and tools, but also human resources who can use them, in the DS (Data Science) area, we are training in-house data scientists who can perform advanced data analysis. In the 7th Mid-Term Plan and beyond, we will also work to raise the level of DX literacy in the entire company by developing DX human resources with such advanced knowledge and skills. In addition to an understanding of the need for DX and a basic knowledge of digital technology, we will also foster a mindset to promote change by giving these employees experience in business reform using no-code and low-code development tools.

2.3 Reinforcement of IT Risk Management

As legacy systems are moved to the open platform and promotion of DS, conversion to CPS (Cyber-Physical System, and workstyle transformation progress

from the steel works to the Head Office, the systems that support these systems will no longer be limited to the company itself, but will be connected through a wide-range, high-speed network, which will include the internet, cloud computing, and even customer systems. While convenience will increase, new cybersecurity risks will also arise. In order to fulfill its responsibilities in the supply chain while ensuring the quality and safety of the values and services provided to customers, it is necessary to adequately protect information assets from such risks. Therefore, the third pillar of DX promotion is risk management.

The JFE Group has established the Information Security Committee and JFE-SIRT (JFE-Security Integration and Response Team) at JFE Holdings to strengthen cross-organizational security measures with a focus on protecting information assets and systems from cyberattacks. In the future, the scope will be expanded to include the foundation supporting DS and CPS in the steel works (IoT, AI, DS) and system service functions provided to customers.

Cyberattacks are also expected to become more intense and sophisticated, and security measures to prevent them are expected to become more complex. JFE Steel aims to move to a "zero-trust" architecture as a new security model in order to improve the level of security management.

3. DX Initiatives in the 7th Mid-Term Plan

The JFE Group's DX strategy in the 7th Mid-Term Plan is to promote DX in all business areas, with a focus on three areas: Innovative productivity improvement, Transformation of existing businesses, and New business creation.

JFE Steel has set "Using 'digital' technologies to strengthen the manufacturing base and execute new growth strategies" as one of its main measures in the 7th Mid-Term Plan, and is planning efforts in each of the three areas that comprise the DX strategy of the JFE Group. The two fields of "Innovative productivity improvement" and "New business creation" will be described in the following.

3.1 Innovative Productivity Improvement

3.1.1 Introduction of CPS for all steelmaking processes

CPS is a system in which the sensor data collected from an actual manufacturing process (physical) is analyzed by AI, an advanced virtual process (cyber) is reproduced in a digital space using an original method, and these two are connected in real time, so that the virtual process can grasp the internal state of facilities

that cannot be seen in reality and predict the future state. Steady operation can be realized by feeding back the results of health monitoring and anomaly prediction to operational actions in the real process, and productivity improvement can be expected by revealing bottlenecks in processes. In addition, process innovation through virtual experiments and technology succession and workstyle reform through mechanization of knowledge and expertise can also be expected.

JFE Steel had introduced CPS at all its blast furnaces in Japan by FY 2020, and introduced technology that can predict the heat condition in the blast furnace up to 8 to 12 hours ahead, which is important for stable operation, as well as predictive detection of abnormalities that may cause serious trouble in the furnace, which had been difficult in the past. In the 7th Mid-Term Plan, introduction of CPS will be completed in all manufacturing processes in addition to the blast furnaces, and construction of integrated CPS for the steel works and the company as a whole will be carried out.

3.1.2 Workstyle transformation using IT

JFE Steel introduced RPA (Robotic Process Automation) in FY 2017 as part of its workstyle transformation and has been making steady progress in labor saving, as shown in **Figure 4**. In FY 2021, the company also introduced an electronic approval tool, J-REMO (JFE Remote Approval Workflow), to reduce the need for the physical presence of employees at worksites to stamp documents and promote paperless stamping. This contributed to workstyle transformation by eliminating the need to store documents in filing cabinets and reducing the time required to search for documents, while also preventing document loss and shortening the lead time between application and completion of approvals.

Workstyle transformation activities, as mentioned in Section 2.2, aim to improve the DX literacy of each employee, and to this end, the system for promoting “citizen development” (i.e., development by employees

without a specialized knowledge of programming) was also strengthened. Citizen development of RPA started in the second half of FY 2020, and citizen development of applications by Power Platform began in the second half of FY 2022. Citizen development using these low-code development tools is possible even by business department employees who are not system engineers because, unlike conventional system development, the programming does not involve a high degree of difficulty. In citizen development, the emphasis is on visualization of work before development and review of unnecessary work to prevent work from becoming a black box and realize real efficiency. Once operational, the logs are monitored, and the IT department calls on users to resolve problems in non-operational or error-prone programs and, in some cases the programs may be discarded. (A detailed discussion can be found in the subsequent paper, “RPA Development Initiatives.”)

As an additional advantage, low-code development tools can be developed and released in a short period of time, allowing citizen developers to quickly cycle through improvements. One of the aims of citizen development is to promote this kind of agile development in the business sector. The IT Innovation Leading Department will continue to actively educate and support business departments, leading to the development of human resources who will play a key role in the promotion of DX.

3.2 New Business Creation

3.2.1 Building platform for solutions business

We will continue to build a platform for selling solutions that will support the development of JFE Steel’s “Solution Business,” which allows external users with service usage agreements (subscriptions) to easily access and use data and solutions. **Figure 5** shows an image of the platform.

This platform makes it possible to continuously provide technology, operation, and research expertise related to high value-added product manufacturing and environmental load reduction to users as solutions.

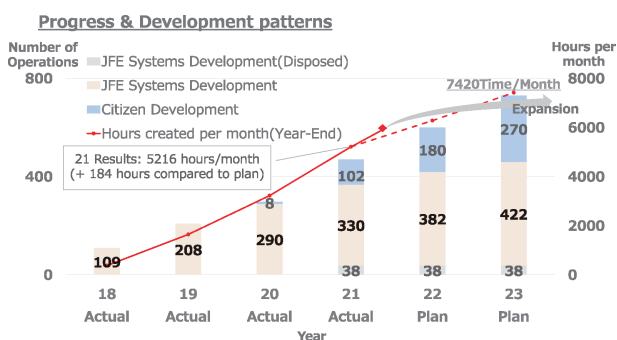


Fig. 4 Development patterns and creation time in RPA development

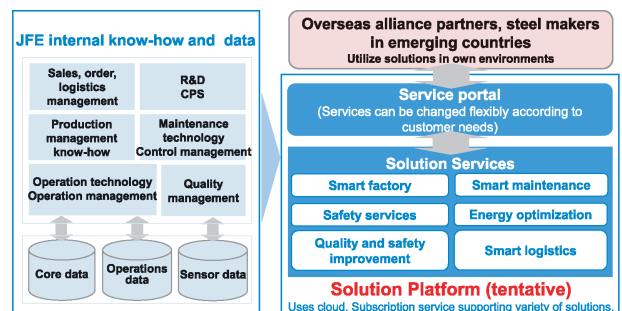


Fig. 5 Platform to expand solutions business

Providing value to users will further increase the added value of the JFE brand, and will establish a stable revenue base that is less influenced by economic trends. Solutions are also expected to be provided to overseas alliance partners and steel makers in emerging countries, which will lead to the acceleration and expansion of overseas businesses. This platform is expected to be completed during the 7th Mid-Term Plan.

4. Conclusion

This paper has described JFE Steel's DX strategy and initiatives in the 7th Mid-Term Plan. However, it is necessary for the entire company, that is, not only the IT division, but also the management and business departments, to work together to promote DX. The development of IT platforms and renewal of existing

systems described in this paper are the first steps to enable the utilization of data assets and access to advanced digital technologies, and continuing DX from here on will be the key to realizing these goals. Based on our management vision and strategy, we intend to lead the way so that each and every employee can make changes as an active participant in DX, leading to company-wide innovation.

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