The Research and Implementation in Digital Transformation of Manufacturing Enterprises

Peng Di

The 14th Research Institute of China Electronics Technology Group Corporation, Nanjing City, Jiangsu Province, China

*Email: pengdi@nriet.com

**Abstract:** This article introduces in detail the typical problems that exist in digital transformation of manufacturing enterprises. It describes the specific methods and strategies for manufacturing enterprises to achieve digital transformation from two aspects: the application of digital resources outside the enterprises and the internal value chain throughout the enterprise. Combined with the implementation case of a specific manufacturing enterprise, it demonstrates the process of the enterprise's digital transformation.

1. **Introduction**

After the international financial crisis, a new generation of industrial technology revolution came into being. In order to cope with new technological challenges, various countries have proposed the strategies of "Returning to manufacturing" or "re-industrialization". The purpose is to enhance the competitive advantage of manufacturing based in the background of information technology. To adjust the unbalanced industrial structure and occupy the highest point of international manufacturing. The Ministry of Industry and Information Technology of China has also successively proposed the development strategies of "Made in China 2025" and "Integration of Informatization and Industrialization", to actively promote the deeply combination of a new generation of information technology and manufacturing as the main line, strengthen industrial basic capabilities, and promote the development and reconstruction of the manufacturing industry, as a result, to form a new momentum for economic growth. With the rapid development of The big data, the IOT, the artificial intelligence, and 5G technology, more and more manufacturing companies are beginning to realize that enterprise digitalization is the general trend. In order to enhance the core competence of enterprises, we must vigorously promote digital transformation and Intelligent manufacturing construction, to realize changes in production methods and organizational methods, that can really help enterprises reduce costs and increase efficiency.

2. **The Information Status and Problems Of Manufacturing Enterprises In China**

2.1 The Insufficient external policy guidance for manufacturing enterprises

Most of the manufacturing enterprises in China still stay in the basic manufacturing link at this stage, which is closely related to the policy direction of local governments. Without external stimulus guidance and local government policy’s support, besides, manufacturing companies generally have low profits, it's difficult for the enterprises to actively promote digital transformation. For this reason, it is also an opportunity for manufacturing enterprises to force the digital transformation with the upgrading of the
country's Manufacturing Power Strategy.

2.2 The Imperfect Information Management Environment Inside the Manufacturing Enterprises

Most of the managers in manufacturing enterprises are promoted through professional technical routes. Focusing on technology and administrative management for a long time, they rarely put in some energy to improve enterprise's information foundation. The ecological environment of the information management inside the enterprise is bad, which is mainly reflected in the following aspects:

2.2.1 Weak awareness of information management and imperfect management system

With the improvement of information technology, the demand for digital transformation of manufacturing enterprises has become stronger. However, the business managers are short of control ability of market dynamics, and information awareness, meanwhile, the industry lacks relatively mature information management standards and systems, which severely constrains the rapid development and reform of enterprises.

2.2.2 Lack of professional technical team, and business management is discontinuous

The informatization construction of enterprises need professional talents to advance. In order to save costs, most of manufacturing companies rarely have reserve of specialized informatization talents. Lacking of professional technical team's support, the companies have no "translator" to communicate with IT companies when promoting digital transformation, which makes it difficult for companies to carry out digital transformation reforms, and it's difficult to promote information construction efficiently.

2.2.3 Low degree of informatization, small coverage and single system for use

Along with the continuous expansion of scale of enterprises, some manufacturing enterprises have begun to perceive the lack of management. However, because of the weak basic capabilities of their own informatization, they do not have the ability to coordinate the construction of informatization systems. They can only use a single system to solve some of the problems. Without considering the continuous construction and integration of the system, the enterprise is limited by boundary conditions during the later informatization construction, which cannot be integrated and optimized well with the previous system.

2.3 Insufficient extension of IT companies towards industrialization

Traditional IT companies focus on their own product development and marketing, and they do not have production experience and management capabilities of manufacturing companies. When assisting manufacturing companies in digital construction, they cannot provide digital overall solutions, customized development and overall operation and maintenance management services suiting companies, own development to facilitate its digital transformation.

3. Methods and strategies for digital transformation of manufacturing enterprises

The transformation of manufacturing enterprises to digitalization and intelligence is a continuous and gradual process. Especially for traditional manufacturing enterprises, they need technology, management, and policy together to promote the progress. It needs the support of information and manufacturing technology, managers' thinking transformation and adjustment of enterprise management structure inside the enterprises; Outside the enterprises, it need national and local governments to issue favorable policies to create a good market ecological environment together with the manufacturing and IT industries.
3.1 Strengthen government’s policy support and the introduction of external digital technology
With the upsurge of the industrial revolution, the state and local governments need to proactively publish favorable policies to promote digitalization, informatization, and intelligent construction, and give local enterprises a certain amount of capital, technology and other resources to support. Enterprises should also actively use policy guidance to promote the mutual help of government, industry, university, research and application, in order to strongly promoted the integration of a new generation of information technology and manufacturing enterprises. At the same time, we must also consciously strengthen exchanges with high-quality companies in digital-related technologies such as industrial Internet, industrial software and automation, and learn about new market dynamics, new management concepts and management models, which inject thinking power into the digital transformation of enterprises.

3.2 Enterprise’s digital planning and implementation
For digital transformation of enterprises, it is necessary to carry out "overall planning and step-by-step implementation" compared with Industry-standard enterprise in accordance with the specific requirements of lean production. According to the strategic development goals of the company, it should analyze the value stream of the company to complete the digital overall planning and road implementation map combing with the status quo of the company. Meanwhile, the company should also apply digital twin technology to optimize the key processes of the manufacturing process, and establish a continuous improvement mechanism to finally achieve the integration and implementation of enterprise digitalization. The specific method is as follows:

3.2.1 Evaluation of the foundation of enterprise digitalization
The core of enterprise digitization is to combine the new generation of information technology, manufacturing technology and enterprise management requirements, and gradually realize the full-life digital control of product design, manufacturing, management, and guarantee, finally to enhance the comprehensive competitiveness of the enterprise. At the beginning of the construction of enterprise digitalization, it is necessary to start with customers’ demands, and conduct a basic assessment of the current state of enterprise digitalization combing with the enterprise digital maturity model, and carry out enterprise digital assessment in many dimensions such as company’s innovative research and development capabilities, the efficiency and economic efficiency of business process control,, personnel
and equipment foundation and so on.

3.2.2 Informatization, digital planning and integration
In the process of digital transformation of enterprises, the construction of information architecture is the core content. Based on the development strategy of the enterprise, it is necessary to sort out the business structure of the entire enterprise, and to decompose the business process layer by layer with taking the value chain as the penetration line, in order to complete the enterprise informatization and digital planning, including: IT basic network security construction for the entire enterprise informatization, Business Intelligence Decision-making (BI), Product Data Management (PDM), Computer Aided Process Planning (CAPP), Enterprise Resource Planning (ERP), Manufacturing Execution System(MES), Human Resources (HR), Project Management (PM), and so on. The restructuring of enterprise business means that the enterprise must rebuild the operating mode between various departments of the enterprise in a new and reasonable way. The construction and optimization of single system and the data integration between systems must fully consider the data flow direction required for management and operation of the enterprise. With the help of the interface definition among various information systems, the enterprise finally forms an interactive blueprint between the data, business and application scenarios required for the digital transformation of the enterprise.

In addition, based on specific production objects, it is necessary to go deep into the current production status of the enterprise. Aiming at the existing process, the company should overall plan the production capacity target and the production cycle balance, and fully consider the utilization of equipment resources, personnel capabilities, data collection, and production environment in order to achieve lean production, flexible manufacturing and assembly as the goal, and the process optimization and automation transformation will be carried out in a targeted manner, which will finish the basic construction work for the digital transformation of the enterprise.

3.2.3 Implementation route of enterprise digitalization
After having a deep understanding of the digital transformation of the enterprise, the implementation route planning can be carried out according to the enterprise's capital and operation situation. The implementation of digitalization requires a dedicated coordinating team. At each stage, it needs to consider fully the theme, main content, capital budget and schedule of the company, to formulate corresponding risk control strategies in order to ensure the smooth transition of enterprises' digital transformation in view of the potential risks in the transformation process.

4. Actual case
Combining with a typical manufacturing enterprise Company A, Company A is a leading company in its own industry, who is a typical multi-variety, small-batch manufacturing enterprise. But the enterprise information foundation is weak, and it lacks an independent information team for management and promotion. As the company's product models are increasing and the R&D payment cycle is increasingly tightened, the demand for advancing the company's digital construction has also become stronger.

In order to accelerate the implementation of the digital transformation strategy and further promote the improvement of company management, Company A actively seeks external digital technology power, to carry out the digital construction of the company with the support of some national and local policies.

Assessing the current status of digitalization, Company A is a typical multi-level organizational unit, whose network is not interoperable, and it plans for plant relocation in recent years. The original information system only has ERP financial management, and there is more room for improvement. After fully investigating the organizational structure and actual business conditions of Company A, a systematic digital plan was carried out for Company A and the implementation roadmap was set as follows:
STEP 1. The project team perform basic network cleaning for the old factory of Company A, and merge the networks of the multi-level organizational structure to achieve network connectivity after partial adjustment and new construction;

STEP 2. The project comprehensively covers the construction and implementation of OA system and HR system, and popularize the basic awareness of enterprise digital office;

STEP 3. With cleaning up the business needs of the enterprise, the project completes the construction of ERP system finance and supply chain, and standardize the requirements of basic material rules, and initially realize the integration of business and finance of the enterprise;

STEP 4. The project analyzes the production process of the product, and summarize the status of the equipments, to screen and improve the key process. And complete the hardware transformation, finally according to the statistical data and demand situation;

STEP 5. The project clarifies the integration interface of each system, and simultaneously carries out the system construction of PDM, CAPP, MES and ERP planned production, to realize the data integration of the design, process, manufacturing, management and other processes based on MBSE;

STEP 6. According to the business needs of the enterprise, the project pushes the key business needs of each information system, to carry out the integrated construction of the BI system, and realize the visualization of the enterprise's management and intelligent decision-making.

So far, the digital transformation of Company A has been initially realized.

5. Conclusion
This article starts from the typical problems that exist in the process of digital transformation of manufacturing enterprises, and addresses the weak awareness of management informatization, the lack of professional teams, and the imperfect internal information management mechanism of the enterprise. From the application of digital resources outside the enterprise, and the internal enterprise The value
chain of the company runs through two dimensions, expounding the specific methods for manufacturing enterprises to achieve digital transformation: with the help of national strategic guidance, strengthen cooperation with politics, learning, research, and application, effectively introduce external digital technology, and provide the basis for the digital status of enterprises Evaluate and take the enterprise value stream as the guide to promote the company’s digital planning. After fully considering the company’s transformation risks, formulate a digital implementation route and risk control strategy that suits the company’s own digital implementation, and take a specific manufacturing company as an example to show It provides a good reference for the digital transformation of similar enterprises.

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