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A case study of intelligent manufacturing transformation framework for manufacturing enterprises

Shi Yong[1,2,*]

[1]*Universiti Tun Abdul Razak, Kuala Lumpur, Malaysia*
[2]*Guangzhou City Construction College, Guangzhou, China*
**Corresponding author*

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Abstract: Based on the development trend of smart manufacturing, this paper analyzes the key factors affecting the transformation of smart manufacturing enterprises in China through enterprise cases and constructs a framework for the transformation of smart manufacturing enterprises in China. The framework includes "smart production" based on "digital technology+ new generation of information and communication technology", "operation digitization" based on "process digitization+ value network synergy", "business digitization" based on "management process reengineering+ organizational structure reshaping" and "organization reengineering" based on "value network reengineering+ data-driven". Among them, the first three factors mainly affect the smart manufacturing transformation of enterprises from the perspectives of resources, demand and environment.

1. Introduction

China's intelligent manufacturing has entered a period of accelerated development, which not only includes the production model of intelligent production and digital operation, but also includes the change of organization model and new business model. Driven by a new round of scientific and technological revolution and industrial transformation, intelligent manufacturing has become an important way to upgrade the manufacturing industry.

At the end of December 2021, eight departments, including the Ministry of Industry and Information Technology, the State Development and Reform Commission, the Ministry of Education, the Ministry of Science and Technology, the Ministry of Finance, the Ministry of Human Resources and Social Security, the State Administration for Market Regulation and the State Assets and Administration Commission of the State Council, jointly issued the "14th Five-Year Plan for the Development of Intelligent Manufacturing" (hereinafter referred to as the Plan). According to the Plan, by 2025, most manufacturing enterprises above designated size will realize digital networking, and key enterprises in key industries will initially apply intelligence. By 2035, all manufacturing enterprises above designated size will be digitalized and networked, and key enterprises in key industries will be basically intelligent.

In this context, Chinese manufacturing enterprises need to accelerate the transformation of intelligent manufacturing, and promote the transformation of enterprises from extensive

development to fine and intelligent development. This article through analyzing the key influencing factors and path of intelligent manufacturing transition of manufacturing enterprises in our country, present corresponding countermeasures and suggestions on intelligent manufacturing transition of manufacturing enterprises in our country.

2. Methodology

China's digital economy is currently undergoing a crucial period of development, and it also presents important strategic opportunities for China to achieve high-quality growth. In the context of a new round of scientific and technological revolution and industrial transformation, the digital economy, as one of the "four new" economies, is becoming a key force to promote high-quality economic and social development.

In terms of promoting digital transformation [1], the process of industrial digitalization is accelerating as China's digital technology is deeply integrated with the needs of enterprises [2]. With its rapid expansion, artificial intelligence is emerging as a new area of growth in the digital economy. Breakthroughs in cutting-edge technologies, such as cloud computing, big data and the Internet of Things, have accelerated, driving the transformation and upgrading of traditional industries. Innovation in the application of digital technologies continued to deepen, and the digital transformation of the industry continued to deepen. Digital technologies promote the transformation and upgrading of the manufacturing industry, promote the integrated development of industries, and help enterprises achieve innovative growth. Deep integration of digital technology and manufacturing plays an important role in improving the level of digitalization of the industry and the toughness of the industrial chain. With the rapid development of the industrial Internet, it helps the digital transformation of traditional enterprises, enables the application, integration and innovation of enterprises through the new generation of information technology, and speeds up the transformation and upgrading of production and manufacturing to the direction of personalization, flexibility and intelligence. The transformation trend is shown in Figure 1.

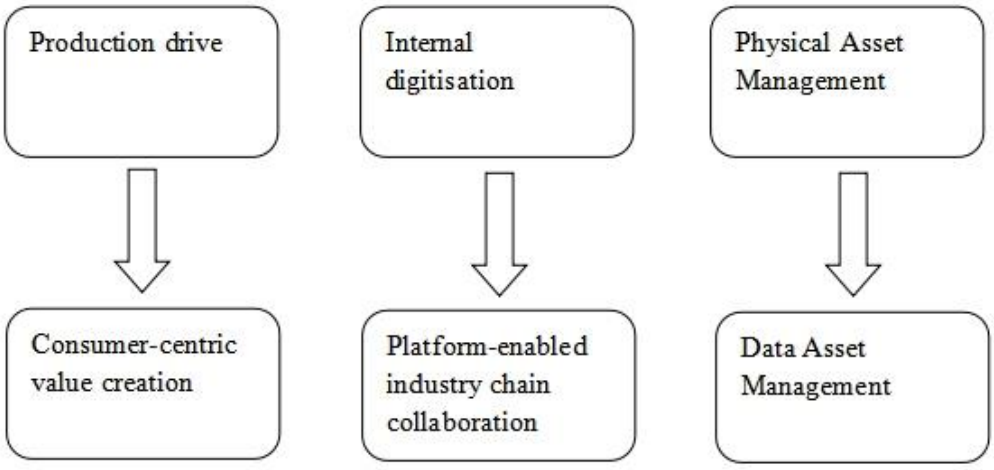

Figure 1: Trend chart for the transformation of traditional sectors

New opportunities and challenges for the manufacturing sector are presented by cloud computing. One of the most critical building blocks and fundamental elements of the digital economy's growth is digitalization. At present, the global manufacturing industry is undergoing three major changes: "demand-side change", "supply-side reform" and "Internet+ manufacturing". At the same time, the digital economy has taken on the new characteristics of "innovation-driven and intelligent transformation", which has promoted the continuous innovation of the production

mode, organizational form and business model of traditional industries. The core of big data is the collection and processing of massive data, which is also the basis for the organic combination of industrial big data and industrial Internet. Through the continuous in-depth analysis and mining of the application of digital technology in various aspects of enterprises, the value of data is rediscovered and remined, which promotes the digitalization of traditional industries from manufacturing to data creation and value increment. Industrial big data also provides new ideas and ways to promote industrial transformation and upgrading. A digital transformation of the manufacturing sector is made possible by an Internet platform. The digital and intelligent development of manufacturing enterprises has faced new challenges and opportunities thanks to the deep integration of data components and Internet technology.

At the same time, the introduction of big data elements will promote manufacturing enterprises to move from traditional manufacturing to a new ecology and a comprehensive digital platform covering the entire production chain and supporting the new external ecology. In addition to promoting the internal division of labor in the value chain and optimizing the value network of manufacturing enterprises, it also improves the market competitiveness of enterprises to a certain extent.

The Industrial Internet is a network that connects various physical entities and network entities based on interconnecting[3], working together, and cooperating. In order to improve production efficiency and product quality, the Industrial Internet can effectively monitor the condition and fault diagnosis of equipment and identify problems in the manufacturing process in a timely manner. Industrial Internet can not only reduce manufacturing costs, improve industrial agglomeration and other advantages continue to be highlighted; it can also achieve effective collaboration within the industry through effective integration and integration of production factors and management means. It can also promote the development and expansion of industrial ecology and build an open and shared data network environment.

Using data, objective phenomena, and systematic verification of facts, empirical findings are used in empirical research. Evidence-based, current, verifiable, and repeatable data are the three primary characteristics of empirical research. The most direct way to see if a study is empirical is to see if it presents data -- not just "quantitative" data, but both quantitative and qualitative data. Therefore, empirical research can be divided into two types of data: quantitative empirical research and qualitative empirical research. According to some, the only type of quantitative research is empirical research. There are some who believe that empirical research is the only type of quantitative research, which is actually a misconception. Interviews, field observations and archival data are all qualitative data[4]. Next, we will use Midea Group as a case study.

3. Results and discussion

Midea Group is headquartered in Beijiao New Town and has been established in Shunde, Guangdong Province since 1968. It has about 200 subsidiaries worldwide, more than 60 overseas branches and 10 strategic business units. Among its businesses are washing machines, kitchen appliances, air conditioning, and a variety of small household items.

A key component of Midea Group's 2020 strategy is global intelligence and digitalization[5]. All products should be defined by software, and users' services should be enhanced by content to change the way Midea Group interacts[6].

In this paper, the content analysis method is adopted. Firstly, by investigating the status quo of intelligent manufacturing transformation of Chinese manufacturing enterprises, the paper summarizes and concludes on this basis. Through literature research, grounded theory, empirical research and other methods to analyze the factors affecting the intelligent transformation and

upgrading of Midea Group, and then from digitalization, online business, operation data, intelligent decision-making, four aspects of the construction of the key factors affecting the transformation and upgrading of intelligent manufacturing enterprises. Its specific research framework is shown in Figure 2. Digitizing facilities and contacts, online service, operational datalization, intelligent decision-making are independent variables. Environmental competition plays a moderating role. The transformation and upgrading of Midea Group is Dependent Variable.

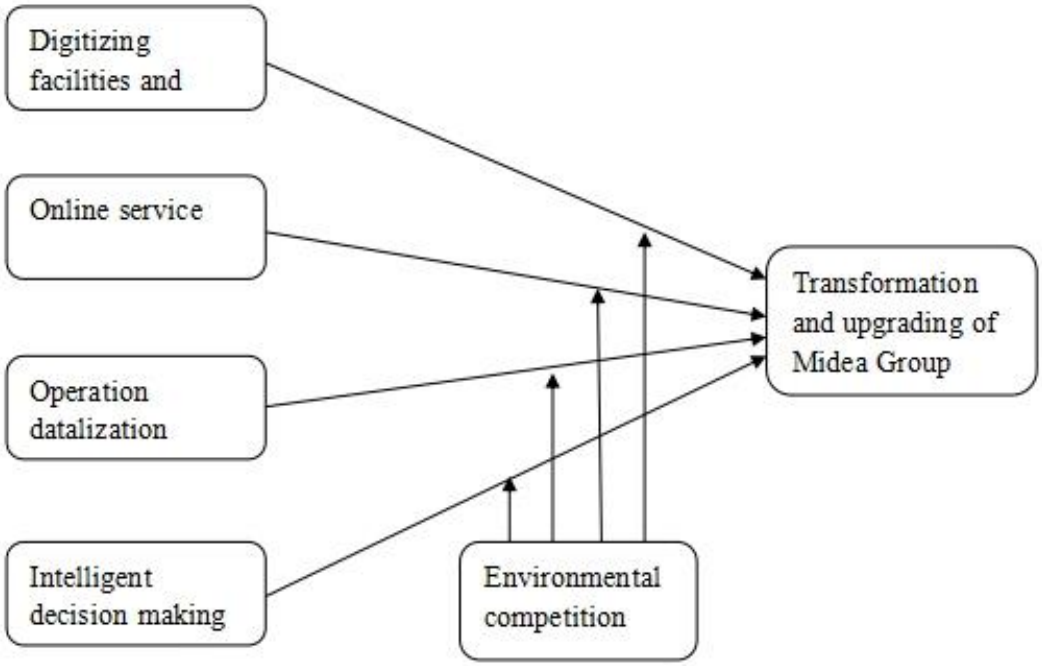

Figure 2: Research framework for the digital and intelligent transformation of Midea

4. Conclusion

The construction of digital intelligent factory is a process of iterative upgrading and continuous evolution. At the end of each cycle, it is necessary to objectively evaluate the construction effect, identify shortcomings, analyze the reasons, and provide direction for future improvement.

Under the background of building a strong national manufacturing country, manufacturing enterprises face the pressure and challenge of digital transformation. By exploring and analyzing the influencing factors of intelligent manufacturing transformation, this paper forms a research framework, in order to provide reference for Chinese manufacturing enterprises to implement intelligent manufacturing transformation.

First, from the external perspective, it mainly analyzes national and government policies, the application of digital technology and the new generation of information and communication technology, the internal capacity-building of enterprises, and the change of management style.

Second, from the internal perspective, it mainly analyzes the impact of digitalization, online business, operation data, intelligent decision-making and four key factors on the intelligent manufacturing transformation of enterprises.

Thirdly, from the micro perspective, the paper mainly explores the construction of digital infrastructure, data-driven business transformation and process management optimization.

Fourthly, from the perspective of industry, this paper selects the key equipment manufacturing industry as a case study.

Finally, the evaluation of enterprise intelligent manufacturing is a difficult point. Different

industries, different product objects have different emphasis on intelligent factory construction, evaluation indicators, index weights are not necessarily the same, so it is necessary for different industries to develop intelligent manufacturing evaluation standards in line with industry characteristics.

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References

[1] Jiang Xiaodan, Liu Lianchen, Wu Cheng. "Digital and intelligent evolution of modern service industry under the condition of new generation information technology ", Computer Integrated Manufacturing Systems, vol.27, no.11, pp. 3049-3056, 2021.

[2] Ye Dan. "Research on the Relationship among IT Capability, Digital Transformation Strategy and Digital Innovation Performance of Traditional Manufacturing Enterprises". Jilin University, 2022.

[3] Lv Wenjing, Chen Jin, Liu Jin. "Intelligent Manufacturing and Firm-Level Platform Building in Industrial Internet: A Case Study of Haier", China Soft Science, no.7, pp. 1-13, 2019.

[4] Wang Hui. "Reserch on the Impact of China's Industrial Intelligence on the Distribution of Manufacturing Enterprises". East China Normal University, 2021.

[5] Xiao Jinghua, Wu Xiaolong, Xie Kang. "Information technology drives the transformation and upgrading of Chinese manufacturing -- a longitudinal case study of the leapfrog strategic transformation of Midea Intelligent Manufacturing". Journal of Management World, vol.37, no.3, pp.161-179, 2021.

[6] Han Lu. "Mechanism and Decision-making Models of Manufacturing Enterprise Supply Chain Digitalization". Beijing Jiaotong University, 2021.