

# Economic Effect Analysis of Manufacturing Digital Transformation from the Perspective of Value Chain

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**Abstract:** With the vigorous development of digital technologies such as big data and artificial intelligence, emerging information technologies continue to pour in and bring great convenience to people's lives, and manufacturing enterprises gradually enter the era of the digital economy and begin to carry out digital transformation. As one of the important pillars of China's real economy, the manufacturing industry is an important force to promote the development of the digital economy. The manufacturing industry has become a key development area because of its strong cyclical industry, high technology content, and capital-intensive characteristics. Based on the study of the digital transformation of manufacturing enterprises, this paper discusses the transformation path of the manufacturing industry to meet the needs of social development from the perspective of the value chain and finally analyzes the impact of digital transformation of manufacturing enterprises on the economic effect from the perspective of the value chain.

**Keyword:** Manufacturing; Digital transformation; Value chain; Economic effect

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## 1. Introduction

The manufacturing industry is the main body of the national economy and plays a vital role in the economic development of the country. With the vigorous development of digital technologies such as big data and artificial intelligence, manufacturing enterprises have gradually entered the era of the digital economy and begun to carry out digital transformation. Digital transformation refers to traditional enterprises based on digital upgrading and digital transformation, breaking through the barriers of enterprise operation and management, adjusting the production and operation mode, innovating the business model and value creation mode, promoting organizational change, stimulating the innovation of marketing channels, and forming a digital and intelligent new enterprise supported by digital technology. Since each production and operation activity of an enterprise

is a process of value creation, to achieve value maximization, the enterprise's value creation activities can be decomposed into a series of interconnected "value-added activities", which are integrated as "value chain." Value chain analysis can decompose an enterprise's digital transformation strategy into each business activity chain, and optimize and integrate each business activity to maximize the value of the enterprise. Therefore, digital transformation is a systematic change involving enterprise strategy, business, process, organization, and talent. Based on the study of the digital transformation of manufacturing enterprises, this paper discusses the transformation path of the manufacturing industry to meet the needs of social development from the perspective of the value chain and finally analyzes the impact of digital transformation of manufacturing enterprises on the economic effect from the perspective of value chain <sup>[1]</sup>.

## 2. Value chain connotation

Value chain analysis was proposed by Michael Porter in 1985. It divides the business activities of an enterprise into several strategy-related value activities, each of which will have an impact on the enterprise and then become the basis for the enterprise to adopt a differentiated strategy. Since each production and operation activity of an enterprise is a process of value creation, to maximize value, the enterprise's value creation activities can be decomposed into a series of interconnected business activities, which are integrated into the value chain. Value chain analysis can decompose an enterprise's digital transformation strategy into each business activity chain and maximize the value of the enterprise by optimizing and integrating all business activities. Combined with the business activities of the enterprise, the value chain can be divided into internal value chain and external value chain <sup>[2]</sup>.

The internal value chain aims to realize the production and delivery of products and is the activity and division of labor among various departments within an enterprise, including research and development, design, manufacturing, marketing, and other links. Through effective coordination and collaboration, each link undertakes a specific task, putting customer needs first, so that products can be smoothly produced and delivered to customers. Through the optimization of the internal value chain process, the existing problems can be found and improved, and the overall performance of the enterprise can be improved. Through the optimization of the internal value chain process, it is also necessary to pay attention to the cooperation of various departments to ensure the coordination and cohesion between all links, and to achieve the maximum value of the enterprise <sup>[3]</sup>.

External value chain includes horizontal value chain and vertical value chain, which refers to the division of labor and cooperation between enterprises, suppliers, and customers. Horizontal value chain through the analysis of competitors' strengths and weaknesses, to develop the corresponding competitive strategy, horizontal value chain analysis can help enterprises to accurately locate and find differentiated competitive advantages. The vertical value chain, including suppliers, distributors, and customers, is the value chain formed between enterprises and upstream and downstream enterprises. Through vertical value chain analysis, enterprises can understand the operation mode of the entire industrial structure, further optimize the supply chain and distribution channels, and improve the overall competitiveness of enterprises <sup>[4]</sup>.

### **3. Problems existing in the digital transformation of manufacturing enterprises from the perspective of value chain**

#### **3.1. The division of labor mechanism of each link in the value chain is missing, and there is a lack of clear data collaboration process**

Digital development is the basic work of building a modern socialist country, and digital transformation is one of the key goals of current development. Therefore, the promotion of digital transformation is also inseparable from the integration of data resources and the optimization and upgrading of infrastructure. With the advancement of digital transformation, enterprises are faced with the lack of inter-departmental division of labor and coordination mechanisms between data departments. Multiple functional departments are required to participate in data acquisition, cleaning, storage, analysis, application, and so on. However, manufacturing enterprises lack clear data processes and related division mechanisms, resulting in the value of existing data cannot be fully mined. The division of data from acquisition to application is unclear, and these issues affect the implementation of digital transformation<sup>[5]</sup>. Due to the different functions of the business and data departments in the manufacturing industry, the business department pays more attention to the specific business needs and implementation process, while the data department pays more attention to the data collection and analysis process. The business department and the data department are relatively independent, lacking effective communication and coordination mechanisms, and the lack of coordination mechanisms leads to insufficient cooperation between the business department and the data department. It is difficult for enterprises to realize the organic combination of business and data in the process of digital transformation, which is not conducive to the transformation and upgrading of the manufacturing industry<sup>[6]</sup>.

#### **3.2. There is a lack of effective strategic support and ability for digital transformation**

In the context of the digital economy era, the digital transformation of enterprises lacks effective strategic support and correct planning. Although the senior management of enterprises realizes the importance of digital transformation, they still cannot clarify how to carry out digital transformation and do not know how to combine digital transformation with corporate strategy<sup>[7]</sup>. Data is the core element of the digital transformation of the manufacturing industry. With the gradual integration of digital technology, enterprises began to build digital basic capabilities and application capabilities. However, the manufacturing industry lacks key core technology and strategic support, resulting in a relatively weak digital transformation basic capabilities. At the same time, due to the long talent training cycle and high cost, the supply and demand of high-end technical talents are unbalanced, and the digital transformation strategy is slowly promoted. Only by closely combining digital transformation with strategy can enterprises better play the value of digital transformation. Only by taking digital transformation as part of the enterprise strategy and clarifying the objectives and directions of digital transformation, can the strategies and measures supporting digital transformation be clearly defined from the strategic level, and the digital transformation be truly implemented<sup>[8]</sup>.

### **4. Digital transformation path of manufacturing enterprises from the perspective of the value chain**

#### **4.1. R&D, production, and intelligent sales to achieve digital product production cycle management**

Through digital technology, manufacturing enterprises can achieve the full life cycle management of products.

The establishment of a product life cycle management system can help enterprises to comprehensively track and manage the development, production, and sales of products, and improve the quality and reliability of products. Through the introduction of advanced digital technology, manufacturing enterprises comprehensively upgrade product design, manufacturing, debugging, and other links, and finally successfully achieve standardized and intelligent products.

In the product research and development stage, enterprises establish an efficient digital research and development platform for product design, adopt digital modeling technology, improve product development efficiency, reduce research and development costs, shorten product research and development cycle, and improve product quality and performance. At the same time, designers can also carry out personalized customized designs according to the different needs of users to improve customer satisfaction.

In the product production stage, manufacturing enterprises take digitalization as the core, introduce digital production line technology, and combine information technology, intelligent manufacturing technology, and industrial automation technology to achieve intelligent, efficient, and sustainable production lines. Through digital modeling and simulation of the production process, while using advanced production management software and information tools, the production process is optimized and the production management process is digitized. Ensuring the normal operation of equipment is the key to ensuring the production efficiency of the manufacturing industry, through the installation of sensors and monitoring systems in the equipment to achieve real-time monitoring of equipment operating status, to avoid the loss of equipment failure to production. At the same time, setting up equipment fault warnings, remote diagnosis of equipment, timely detection and solution of equipment faults and anomalies minimize the impact of equipment faults on production, ensure the stable operation of equipment, improve production efficiency, and strengthen the basic digital capabilities<sup>[9]</sup>.

In the product sales stage, the manufacturing industry actively seeks to digital transformation of sales methods. Based on the realization of business process informatization, the manufacturing industry creates customer management, sales management, after-sales service management, business analysis, and other modules to realize the integration of customer information, intelligent classification, and prioritization, accurately judge the potential needs of customers, formulate different sales strategies for different customer groups, and further improve sales efficiency and customer satisfaction.

## **4.2. Suppliers, customers, and partners are collaborative, and the whole process of product production is digitized**

Through digital technology, manufacturing enterprises can realize the whole process management of product production. The digitalization of the whole process of product production can help enterprises comprehensively track and manage suppliers, customers, partners, and other links, and improve product quality and reliability. Through the introduction of advanced digital technology, manufacturing enterprises comprehensively communicate and coordinate with material suppliers, cooperative trading parties, customers, and other links, and finally successfully realize the synergy of suppliers, customers, and partners<sup>[10]</sup>.

The supply chain is a crucial link in the manufacturing industry, which establishes a supplier portal system. It includes the whole process from raw material procurement to final product delivery, including supplier management, procurement management, production planning, warehousing and logistics, sales, and distribution. An efficient supply chain can help enterprises reduce costs, improve quality, shorten the delivery cycle, improve customer satisfaction, and thus improve the market competitiveness of enterprises. In the past, when there were a

large number of suppliers, enterprises could not effectively manage them, and it was difficult to obtain data such as the price and transportation status of purchased products the first time, resulting in low supply chain efficiency and easier to affect the production schedule of enterprises.

The customer management system in the manufacturing industry enhances the digital transformation of the downstream clients of the enterprise's external value chain. The system can comprehensively manage customer information to ensure that enterprises can have a comprehensive understanding and cognition of customers. At the same time, the researchers can deeply dig and analyze the relevant data of customers, deeply understand the consumption habits and purchase history of customers, and conduct research and development design and make production plans based on this, to meet the needs of customers for high-quality services.

In terms of partners, the manufacturing industry actively carries out industry-university-research cooperation, vigorously promotes research and development and exchanges in the field of new technologies, strengthens research and development and production capacity, improves the differentiated competitiveness of products, and promotes the industrialization of scientific and technological achievements. At the same time, the manufacturing industry through cooperation with more industry enterprises to achieve resource sharing and complementary advantages, can greatly expand the market and business scope of the manufacturing industry, accelerate technological innovation and product research and development, consolidate the digital capability of the manufacturing industry, promote the transformation of manufacturing results, promote industrial agglomeration and development, and improve the overall competitiveness of manufacturing enterprises<sup>[11]</sup>.

## **5. Analysis of the economic effect of digital transformation of manufacturing enterprises from the perspective of value chain**

### **5.1. Economic effect analysis of digital transformation from the perspective of the internal value chain**

From the point of view of research and development. People are the key element of the R&D process. By improving multi-channel cooperation and incentive mechanisms, the manufacturing industry has implemented the plan of doubling high-end scientific research talents, established R&D centers and innovation platforms, and attracted outstanding scientific research talents at home and abroad. The proportion of scientific research personnel has shown a rapid growth trend, and R&D investment has increased year by year, providing a strong guarantee for the research and innovation of the manufacturing industry, and striving to make the quantity and quality of scientific and technological output reach the best level. It shows that the manufacturing industry attaches great importance to R&D innovation and focuses on improving the R&D conversion rate.

From the production link point of view, the manufacturing industry has introduced a large number of advanced digital technologies to enable production and manufacturing processes, and actively explored and applied new technologies in fields such as artificial intelligence and big data, aiming to improve production efficiency and product quality. At the same time, the manufacturing production control center realizes comprehensive control and management, allowing enterprises to discover and deal with equipment failures in real time. The digitalization of production links helps enterprises to realize the optimization and coordination of the entire production process, reduce manufacturing costs, and improve product quality and production efficiency<sup>[12]</sup>.

From the point of view of sales, the manufacturing industry should establish a sales information platform to achieve real-time tracking and in-depth analysis of customer information. Through centralized management, design customized sales plans, attract more potential customers, provide customers with personalized services,

improve the conversion rate of sales expenses, and expand enterprise market share. At the same time, by building a marketing platform to expand the depth and breadth of marketing, vigorously promote the brand and product information of the enterprise, increase brand exposure and market coverage, and improve the sales share of manufacturing products. Overall, the digital transformation measures in the sales link have helped the manufacturing industry to optimize the process management system, which has greatly enhanced the profitability and operational capacity of enterprises <sup>[13]</sup>.

## **5.2. Economic effect analysis of digital transformation from the perspective of the external value chain**

From the supplier side, by building a global supplier portal system, the manufacturing industry strengthens the supervision and management of suppliers, improves the operational efficiency and transparency of the supply chain, and increases the diversification of supplier selection channels. The platform, from supplier selection before procurement to tracking product logistics information after procurement, realizes the whole process supervision of product procurement, greatly reduces a series of risks caused by supplier price, quality, and logistics management problems in the procurement process, and improves the production and procurement efficiency of the manufacturing industry <sup>[14]</sup>.

From the client's point of view, the manufacturing industry has launched a series of cloud services to provide customers with convenient, efficient, and all-round experience and services, and realize the digital service model combining cloud and terminal. Customers can monitor a series of services such as spare parts ordering through terminal equipment in real time. The new service model can effectively improve customer satisfaction and thus increase product market share, strengthen the competitive advantage of the manufacturing industry, bring more commercial value to the manufacturing industry, and finally achieve value maximization.

From the partner side, the manufacturing industry actively carries out industry-university-research cooperation, vigorously promotes research and development and exchanges in the field of new technologies, enthusiastically assists public welfare undertakings, and actively performs the social responsibility of the manufacturing industry, aiming to achieve cross-industry and cross-sector integration through the establishment of an efficient and orderly mechanism, accelerate the development of the industry and improve the sustainable development capacity of the manufacturing industry <sup>[15]</sup>.

## **6. Conclusion**

To sum up, after digital transformation, manufacturing enterprises have made remarkable progress in product design and development, production and manufacturing, customer service and marketing, and cooperation with enterprises in other industries. These advances not only enable the manufacturing industry to make breakthroughs in innovation potential and gain a more favorable position in market competition but also provide customers with better product and service experience. After the implementation of digital transformation, the manufacturing industry has realized the digitalization of product production cycle management, including the intelligence of research and development, production and sales, and the digitalization of the whole process of product production, including the collaboration of suppliers, customers, and partners. In this case, the manufacturing industry should make full use of its advantages, strengthen technological innovation and research and development investment, take digital technology as the starting point, cultivate high-end talent teams, launch high-quality products that are more in line with market demand, and improve the comprehensive competitiveness

of enterprises.

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