

Research on the impact of digital economy on my country's manufacturing upgrading

-- Based on the perspective of spatial layout of the industrial chain

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Abstract

With the profound changes in the global industrial economic situation and the further adjustment of the industrial competition pattern, the stability and security of my country's industrial chain and supply chain are facing major risks. In this context, promoting the digital transformation of the manufacturing industry has become the only way for the transformation and upgrading of the manufacturing industry. This paper first analyzes the mechanism of my country's digital economy driving the upgrading of the manufacturing industry, and examines it from the perspective of the spatial layout of the industrial chain, aiming to enrich the theoretical basis of the digital economy driving the development of the real economy, and provide useful countermeasures for my country's manufacturing industry to achieve upgrading under the drive of the digital economy. It has important theoretical and practical significance. This paper starts with "digital economy drives the spatial layout reconstruction of the manufacturing industry chain" and takes "realizing the upgrading of the manufacturing industry" as the ultimate goal. The reasonable spatial layout of the manufacturing industry chain and the upgrading of the manufacturing industry are two important aspects of the high-quality development of my country's manufacturing industry. The reasonable spatial layout of the manufacturing industry chain can promote the rational allocation of factor resources, narrow the regional gap, and realize the upgrading of my country's manufacturing industry more efficiently and comprehensively. Therefore, this paper studies the reconstruction of the spatial layout of the manufacturing industry chain driven by the digital economy, which can not only enhance the resilience of my country's manufacturing industry chain and supply chain, but also provide a path for the upgrading of the manufacturing industry. The two complement each other. Through systematic analysis and verification, this study reveals the role of the digital economy in promoting the reconstruction of the spatial layout of the manufacturing industry chain, and thus provides theoretical support and policy recommendations for achieving high-quality development of the manufacturing industry.

Keywords

Digital economy, manufacturing upgrading, industrial chain, spatial layout.

1. Introduction

1.1. Research Background

With the profound changes in the global industrial economic situation, the industrial competition pattern is further adjusting, the international situation is complex and changeable, and the reorganization of the global supply chain has become a general trend. Especially after the COVID-19 pandemic, the fragility of the global supply chain has been fully exposed, international trade frictions have intensified, and geopolitical risks have risen, making my country's industrial chain and supply chain face unprecedented challenges and major risks. Against this background, ensuring the stability and security of the industrial chain and supply chain and enhancing the risk resistance and resilience of the industrial chain have become the core tasks of my country's high-quality development of the manufacturing industry.

At the same time, the rapid development of the digital economy has provided new impetus for the transformation and upgrading of the manufacturing industry. With the widespread application of new generation information technologies such as the Internet of Things, big data, cloud computing, and artificial intelligence, the production model, management mode, and business model of the manufacturing industry have undergone profound changes. Digital transformation not only helps to improve production efficiency and product quality, but also optimizes resource allocation, reduces operating costs, and enhances innovation capabilities, thereby gaining an advantage in fierce international competition. In this process, the reasonable spatial layout of the industrial chain is particularly important. The spatial layout of the manufacturing industry chain is related to the reasonable allocation of factor resources and the coordinated development of regional economies. Reasonable spatial layout can not only promote balanced economic development among regions, but also enhance the synergy of industrial clusters and enhance the overall competitiveness of the industrial chain. However, my country's manufacturing industry is still facing many challenges in the process of digital transformation, such as insufficient deep integration of information technology and manufacturing, lack of digital talents, and data security risks. In addition, the imbalance in the level of digital development among different regions has also led to the dispersion of the industrial chain layout and inefficient resource allocation.

In view of this, studying the spatial layout reconstruction of the manufacturing industry chain driven by the digital economy and exploring the path to achieve manufacturing upgrading not only has important theoretical value, but also has practical guiding significance for the actual development of my country's manufacturing industry. By systematically analyzing the impact of the digital economy on the spatial layout of the manufacturing industry chain and proposing a scientific and reasonable layout strategy, it can provide strong support for improving the resilience of my country's manufacturing industry chain supply chain and achieving high-quality development.

1.2. Significance

1.2.1. Theoretical significance

Based on the realistic background of the development of China's manufacturing industry and digital economy, studying the driving role of the digital economy on the manufacturing industry under the socialist market economy system has important theoretical significance for refining and summarizing the construction of a digital economy and manufacturing industry integrated development path with Chinese characteristics. In the process of digital transformation of China's digital economy and manufacturing industry, it will not only face the general laws and characteristics of the development process of Western countries, but also inevitably develop a special model of digital development of socialist manufacturing industry with Chinese characteristics. Based on summarizing the general experience of the evolution process of my

country's manufacturing industry chain, this project will grasp the current development situation and refine a digital transformation model of manufacturing industry with Chinese characteristics.

At the same time, the digital economy is a new driving force for China's economic development under the new normal, and it is also an important force in leading the implementation of a series of national innovation strategies. Exploring the measurement system of digital economic development level has certain practical reference value for related research on the digital economy. This project aims to build a digital economic development level evaluation system from four perspectives, including digital foundation, digital industry, digital integration and digital development environment, based on the principles of comprehensiveness, scientificity, hierarchy, purpose, comparability, consistency of evaluation methods and operability, taking into account the interrelationship of each indicator while also reflecting different aspects of the problem, and promoting the innovative development of the digital evaluation system.

1.2.2. Practical significance

First of all, it has certain practical reference value for strengthening and supplementing the industrial chain of my country's manufacturing industry and improving the autonomy and stability of the industrial chain and supply chain. In the process of my country's economic development, differences in regional resource endowments, location advantages, industrial structure and other aspects have become the driving force behind the gap in manufacturing development between regions. In the era of digital economy, the layout space of the manufacturing industry chain has been extended, and the dual layout of online and offline has stimulated new market space. This project focuses on the role of digital economy in the division of labor in the manufacturing industry chain and the main competitiveness of manufacturing in various regions, in order to provide a practical guide for the reasonable layout of my country's manufacturing industry, so as to give play to greater comparative advantages and higher industrial levels, and stimulate the full realization of economic potential.

Secondly, it has certain practical reference value for deepening the digital transformation of my country's manufacturing industry and realizing the comprehensive upgrading of the manufacturing industry. Starting from the development level of digital economy in various regions and the digital level of the manufacturing industry chain, this project explores the factors that hinder the digital transformation of the manufacturing industry in various regions, and extends the driving role of the digital economy on the upgrading of the manufacturing industry to the spatial scope, so as to more scientifically grasp the role of the digital economy in driving the upgrading of the manufacturing industry in various regions. For the digital transformation of the manufacturing industry in various regions, giving full play to the driving role of the digital economy in the upgrading of the manufacturing industry and achieving high-quality economic development, it is of great practical significance.

2. Literature review

2.1. Research on the upgrading of manufacturing industry driven by digital economy

Manyika et al. (2011) found that the digital economy has a significant role in promoting the transformation and upgrading of the manufacturing industry. From the perspective of changes in enterprise resource allocation capabilities, advanced information technology can promote information exchange and knowledge sharing among industries, thereby achieving industrial upgrading (Liu Jichao et al., 2013). The widespread application of digital technology allows enterprises to achieve rapid penetration of knowledge and information at a lower cost during the construction of advanced technologies (Bloom, 2014). Usually first-tier cities have a higher level of digital economic development due to their own level of talent and technological element

concentration (Chu Nanchen, 2018). However, because of the large scale of these cities, "urban diseases" caused by excessive population concentration may occur. "Thus hindering the effect of the digital economy on industrial upgrading (Li Songlin et al., 2017). Xiao Xu et al. (2019) based on the value dimension theory, verified the role of digital economy in promoting the optimization and upgrading of industrial structure. Cai Yanze et al. (2021) found in their research that the digital economy can regulate the innovation environment and promote the transformation and upgrading of the manufacturing industry. The digital economy can mobilize customers' enthusiasm to participate in manufacturing production. From the perspective of customer participation, the widespread application of the Internet in manufacturing R&D departments can accelerate the internal technological innovation of enterprises.

2.2. Research on the relationship between digital economy and industrial chain

Bakos (1977), Anderson et al. (2004) and others believe that the digital economy can reduce various costs in the production and transaction processes of enterprises, thereby realizing the reconstruction of the value chain. RAviles (2015) found that the application of cloud computing technology can promote the integration between supply chain organizations, thereby enhancing the market competitiveness of enterprises. Hazen et al. (2016) analyzed the impact of digital technology level on supply chain sustainability from eight theoretical perspectives and believed that as digital technology continues to mature and be applied, it can continue to provide competitive advantages for the supply chain. The rapid development of information and communication technology has become a driving force for economic globalization. It has also made the decomposability of various links in the global value chain and the tradability of intermediate products more and more prominent. Resource allocation has continued to be decentralized, accelerating the reconstruction of the global value chain (Korea Jian et al., 2018) and He Wenbin (2020) found in their research that digital investment has a positive role in promoting the high-end global value chain in the low-medium and medium-high technology-intensive manufacturing sectors. Among them, the value chain of medium-low technology-intensive industries The effect of improving the status of division of labor is more significant (Qi Junyan et al., 2021).

2.3. Research on the spatial layout of the industrial chain

Alfred Weber proposed the theory of industrial location, emphasizing the impact of transportation costs, labor costs and agglomeration effects on enterprise location selection. Weber believed that enterprises would choose to produce in locations with the lowest total costs. Alfred Marshall proposed the theory of industrial agglomeration, pointing out that the external economic effects brought about by enterprise agglomeration, such as technology spillover, market sharing and specialized division of labor, can improve the production efficiency and innovation capabilities of enterprises.

Domestic scholars have conducted a large number of studies on the spatial layout of industrial chains, mainly focusing on the following aspects: Characteristics of spatial layout of China's manufacturing industry: Li Xiaofeng (2020) pointed out that the spatial layout of China's manufacturing industry shows an obvious trend of coastal concentration. However, in Driven by policies, industries gradually spread to the central and western regions, forming a multi-center, multi-level spatial pattern. Wang Xiaohong et al. (2021) found through empirical research that coastal areas are still the main agglomeration areas of China's manufacturing industry, but the industrial agglomeration effect in the central and western regions has gradually emerged, and the industrial layout among regions has tended to be balanced. Research by Zhang Wei (2019) shows that industrial agglomeration has a significant promoting effect on regional economic growth. Taking the Yangtze River Delta and Pearl River Delta as examples, these regions have achieved rapid economic development and structural

optimization through industrial agglomeration. Chen Zhiyuan (2020) analyzed the impact of industrial agglomeration on local government financial resources and found that industrial agglomeration not only enhances local economic strength, but also enhances local fiscal revenue. Li Xiaochen (2022) studied the impact of national policies on the spatial layout of industrial chains and found that policies such as the “Belt and Road” initiative and the coordinated development of Beijing-Tianjin-Hebei have significantly promoted industrial transfer and development in the central and western regions.

International scholars' research on the spatial layout of industrial chains mainly focuses on the global value chain, the impact of the digital economy and cross-national comparisons. Greeff (2019) proposed that the spatial layout of the global value chain reflects the different roles of developed and developing countries in the global division of labor. Developed countries are mainly engaged in high value-added links, while developing countries are more involved in low value-added manufacturing links. Tim Sturgeon (2020) studied the dynamic changes of the global value chain and pointed out that multinational companies have improved production efficiency by optimizing resource allocation through global layout, but also brought new challenges, such as supply chain risks and regional imbalances. Erik Brynjolfsson (2018) showed that the development of the digital economy has greatly changed the spatial layout of the traditional industrial chain. The widespread application of information and communication technology (ICT) enables enterprises to allocate resources more flexibly and reduce the restrictions of geographical location on production.

3. Concept and theoretical basis

3.1. basic concept

3.1.1. Digital Economy

Digital economy refers to a new economic form that is based on digital technology and information and communication technology, uses emerging technologies such as big data, cloud computing, artificial intelligence, and the Internet of Things, and achieves resource allocation optimization, innovation-driven, and value creation through the Internet platform. Digital economy not only includes the development of digital industries (such as information technology, e-commerce, etc.), but also covers the digital transformation and intelligent upgrading of traditional industries. The core elements include data resources, digital technology, digital infrastructure, and digital applications. The main characteristics are efficiency, intelligence, interconnection, and innovation-driven.

3.1.2. Spatial layout of the industrial chain

The spatial layout of the industrial chain refers to the spatial distribution pattern of enterprises and related activities in each link of the industrial chain within a certain geographical area. It reflects the geographical location choices of enterprises in production, supply, sales and other aspects and their mutual relationships. Reasonable spatial layout of the industrial chain can promote the efficient use of resources and the coordinated development of the regional economy. The core elements include enterprise location selection, industrial agglomeration effect, regional economic foundation and policy environment. The main modes are centralized layout (such as industrial clusters), decentralized layout (such as global value chains) and network layout (such as digital supply chains).

3.1.3. Industrial upgrading

Industrial upgrading refers to the process of optimizing and adjusting the industrial structure and production methods under the impetus of technological progress, innovation-driven and market demand changes, so as to achieve the development of the industry towards high added value, high technology content and high efficiency. Industrial upgrading usually includes

product upgrading, technology upgrading, organizational upgrading and model upgrading. It includes technological innovation, market competitiveness, industrial structure optimization and human capital improvement. The main path is to achieve high-quality development of the industry through technological progress, management optimization, innovation-driven and industrial chain extension.

3.2. Theoretical basis

3.2.1. Factor endowment

The factor endowment theory reveals the basic laws of international trade and industrial layout by explaining the differences in production factors between countries. Applying the factor endowment theory to the study of the spatial layout of the industrial chain helps to understand and analyze the industrial distribution and its economic effects in different regions. By explaining the impact of the relative abundance of production factors on the industrial layout, it provides an important theoretical basis for understanding the spatial layout of the industrial chain. The new economic geography theory and classical theorems further enrich this theoretical framework, explaining the impact of economies of scale, agglomeration effects and changes in factor prices on spatial layout. In the context of globalization and the digital economy, the complexity of the industrial chain layout has increased, but factor endowments remain a key factor in understanding this phenomenon. Future research should continue to combine the factor endowment theory with the new characteristics of modern economic development to explore more complex industrial chain spatial layout mechanisms.

3.2.2. Comparative Advantage

The theory of comparative advantage has been expanded and developed on this basis, further explaining the complex spatial layout of the industrial chain. The theory of comparative advantage not only explains the trade patterns between countries, but also provides a theoretical basis for the phenomenon of industrial clusters within the region. Industries with comparative advantages in the region further enhance their competitiveness through agglomeration effects. With the change of comparative advantages, the spatial layout of the industrial chain will also undergo dynamic adjustments. Industrial transfer and upgrading are usually accompanied by changes in factor prices and technological levels.

3.2.3. Value chain theory

The gradually refined social division of labor has made the production process increasingly clear. In the mid-1980s, the value chain theory came into being. Porter, the originator of this theory, believes that the value system of an enterprise includes four major entities: suppliers, manufacturers, sellers and consumers. The four major entities form different value chains and are interconnected. According to the different participating entities and scopes, they can be divided into internal value chains and external value chains of enterprises. The participants of the internal value chain are enterprises, which can be divided into basic activities and supporting activities. It is the process of enterprises actively creating value. The external value chain is composed of transaction activities between enterprises and upstream and downstream entities such as suppliers, sellers and consumers. It is the process of creating value through mutual transactions among stakeholders. Porter's value chain theory shows that enterprise competition is not only a competition for a core link in the value chain, but also a competition from low value chains to high value chains. This theory is the basis of the global value chain theory.

4. Analysis on the current status of development of digital economy and manufacturing industry in my country

As a new driving force for economic growth, the digital economy is profoundly changing the global industrial landscape and economic structure. As the world's second largest economy, China is vigorously promoting the deep integration of the digital economy and manufacturing industry to achieve industrial upgrading and high-quality economic development. This article will comprehensively analyze the development status of my country's digital economy and manufacturing industry, and explore the trends and challenges of their integrated development.

4.1. Current status of my country's digital economy development

China's digital economy continues to expand and has become one of the largest digital economies in the world. According to the "China Digital Economy Development Report (2023)", China's digital economy will reach 45.5 trillion yuan in 2022, accounting for 39.2% of GDP. The growth rate of the digital economy is significant, higher than the growth rate of the overall economy. Especially during the epidemic, the digital economy has shown strong resilience and vitality, becoming an important support for economic growth; China has made significant progress in core technology fields such as artificial intelligence, blockchain, big data, and cloud computing; enterprises and scientific research institutions investment in R&D in digital technology has been increased, technological innovation capabilities have been continuously enhanced, digital transformation of the manufacturing industry has been accelerated, intelligent manufacturing has become an important direction for the transformation and upgrading of the manufacturing industry, and positive progress has been made in the construction of industrial Internet platforms and smart factories.

4.2. The development status of my country's manufacturing industry

The current status of China's manufacturing industry development shows a trend of steady improvement and high-quality development. Structural optimization and transformation and upgrading: In recent years, China's manufacturing industry structure has been continuously optimized, and the quality of development has been steadily improved. High-end manufacturing has grown rapidly, with the added value of aerospace and equipment manufacturing increasing by 22.9% year-on-year, and the manufacturing of special equipment for semiconductor devices and electronic components and electromechanical components increasing by more than 30% year-on-year. The production of new products such as intelligent and new materials has improved, with the manufacturing of intelligent consumer equipment increasing by 12%, among which the manufacturing of intelligent vehicle-mounted equipment and intelligent unmanned aerial vehicles increased by 36.3% and 12.5% respectively. These data show that China's manufacturing industry is developing in the direction of high-end and intelligent. Overall scale and global status: China's overall manufacturing scale has ranked first in the world for 14 consecutive years. In 2023, the added value of industrial enterprises above designated size will increase by 4.6% year-on-year, an increase of 1 percentage point from 2022. Among the 41 major industrial categories, 28 maintained growth, and the average growth rate of the top ten key industries exceeded 5%. These data reflect the strong growth momentum of China's manufacturing industry and its important position in the global industrial chain. Innovation capability and industrial upgrading: Major innovative achievements continue to emerge, small and medium-sized enterprises are on the road of specialization, precision and innovation, industrial structure is upgrading faster, export structure continues to improve, and regional layout is constantly optimized. Experts believe that although the internal and external environment remains severe and complex, China has advantages such as a complete industrial system, a super-large market and a complete information infrastructure. The long-term positive trend of the economy will not change, and

the manufacturing industry will accelerate the development of high-end, intelligent and green. In the face of a complex and changing external environment and multiple challenges, China's manufacturing industry has achieved structural optimization, quality improvement and scale expansion through the implementation of a series of policies to stabilize growth and industrial transformation and upgrading measures, showing a good trend of high-quality development.

5. Conclusion and Suggestion

The digital economy, which has both technical attributes and economic forms, has developed rapidly and gradually penetrated into all aspects of the economy and society, profoundly changing the way of production and life, and triggering systemic changes. Manufacturing is an important sector of the national economy. Actively adapting to the development of the digital economy and releasing the vitality of manufacturing development are of great significance to achieving high-quality development of the manufacturing industry faster and better. Based on the mechanism analysis in the previous article, the following suggestions are put forward:

5.1. Continue to promote industrial digitization and digital industrialization

Increase support for the digitalization, intelligence, and networking transformation of the manufacturing industry, and leverage the digital economy to break through the "neck" technology constraints. By formulating and implementing a national digital transformation strategy, issuing policies and regulations to support the digital transformation of the manufacturing industry, setting up special funds and subsidies, and reducing the financial pressure of digital transformation of enterprises, at the same time, increase investment in research and development of key core technologies, promote the application of intelligent manufacturing technology, and realize the automation, intelligence, and informatization of the production process. In addition, it is necessary to strengthen talent training in the fields of digitalization and intelligent manufacturing, improve the vocational education and training system, attract global high-end technical and management talents through talent attraction plans, and provide intellectual support for the digital transformation of enterprises. Encourage provinces (autonomous regions, municipalities directly under the central government) to establish digital green industrial parks, attract high-quality digital technology companies and manufacturing companies at home and abroad through scientific planning and green construction, promote collaboration and innovation among enterprises in the park, promote industry-university-research cooperation, share technical resources and market information, and achieve complementary advantages. Build a digital industry ecosystem composed of digital technology companies, manufacturing companies, financial institutions, and innovative companies, promote in-depth cooperation among various types of companies, form a close industrial chain and supply chain relationship, promote industrial interconnection, achieve technological upgrading, and help China's manufacturing industry develop with high quality.

5.2. Leverage the advantages of the digital economy to promote the integration of manufacturing and service industries

The integration of manufacturing and service industries is a new trend in industrial development. Empirical analysis shows that the integration of manufacturing and service industries plays a partial intermediary role in the impact of the digital economy on the high-quality development of the manufacturing industry. Therefore, the high-quality development of the manufacturing industry should leverage the digital economy to promote the integration of manufacturing and service industries. First, consolidate the foundation of the service industry. The integration of manufacturing and service industries requires a strong foundation of the service industry. In 2015, the output value of China's tertiary industry exceeded the sum of the output values of the primary and secondary industries for the first time, accounting for

more than 50% of the gross national product, indicating that China's service industry has a strong momentum of development, but China's service industry trade deficit is large, and it is still dominated by imported services, indicating that China's service industry has not yet met the needs of its own development. To consolidate the foundation of the service industry, first, adjust the industrial structure of the service industry, vigorously develop productive services that are closely related to the manufacturing industry, such as finance, leasing, R&D and logistics, and use the advantages of the service industry to make up for the shortcomings of the manufacturing industry. Second, actively attract talents. The service industry is highly personalized and professional, with a large demand for labor and high requirements for labor quality. It is necessary to strengthen the training of professional talents in the service industry, attract professional talents to flow to the service industry, and make up for the talent demand gap in the service industry. The third is to leverage the digital economy to develop the service industry. The service industry is characterized by point-to-point personalized services, with low labor productivity. The analysis and mining of customer demand information will determine the quality of service provided. The digital economy uses information technology as a breakthrough point to help the service industry expand its time and space connection with customers, strengthen enterprises' ability to collect and analyze customer information, and improve the service quality and demand matching of the service industry.

5.3. Mobilize the initiative of innovation entities and strengthen innovation drive

Innovation is the driving force of economic development. In the context of digital economic development, manufacturing innovation is a systematic project. Manufacturing enterprises at the forefront of the market should collaborate with multiple innovation entities to drive development with innovation. Manufacturing enterprises should strengthen their own business model innovation. In the era of digital economy, the development of e-commerce has set off a wave of business model innovation. Enterprises should actively adapt to the background of digital economic development. First, enterprises should analyze the nature, product structure and market size of their own products, formulate personalized business models, rationally layout online and offline sales channels, scientifically plan regional markets, open up e-commerce channels suitable for their own development, and avoid copying competitors' business models and wasting resources. Second, enterprises should create a cultural atmosphere that advocates innovation, improve the organizational structure and management model of enterprises, establish a flat organizational structure, appropriately delegate power to subordinates, improve the flexibility of enterprises to market changes, actively adapt to systematic business model innovation, and avoid being swept away by the wave of e-commerce.

5.4. Strengthen the construction of digital economy talents and adapt to new talent demands

The digital economy has strong technical attributes and is closely related to emerging information technology. In the process of penetrating into the development of the manufacturing industry, existing talents are difficult to meet the new talent needs for high-quality development of the manufacturing industry under the background of the digital economy. Therefore, talent development should be strengthened. Attach importance to investment in digital technology research and development and talent training, and strengthen the protection of intellectual property rights for digital innovation technologies. Government departments should accelerate the market-oriented reform of factors, reduce unreasonable intervention in the factor and product markets, and provide policy preferences for innovative R&D companies; improve the professional talent training system, and the government and enterprises can jointly build a digital economy talent training center to provide digital skills

training and certification for practitioners; increase the protection of scientific research results and technological innovations, increase the investigation and punishment of infringements, and encourage manufacturing companies to promote collaborative innovation between industry, academia and research.

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