

The Impact Mechanisms of Digital Economy on China's Manufacturing Industry's Global Value Chain Division

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Abstract

With the changes in the world economic situation, the traditional manufacturing industry, which participates in the global value chain (GVC) by relying on low value-added production activities, no longer holds an advantage. China's manufacturing industry is in urgent need of finding a new driving force for development and innovatively engaging in the GVC's division of labor. At the same time, the scale and total volume of the domestic digital economy continue to increase, and the acceleration of industrial digitization and the smooth promotion of digital industrialization have significantly improved the overall quality of the social economy. This paper investigates how the digital economy influences China's manufacturing industry's role in the GVC, using literature review method to explore this relationship. The results reveal that there are three mechanisms of the digital economy's impact on China's manufacturing industry, which are direct impact, indirect impact and spatial spillover effect. Additionally, if the digital economy-related technologies are used to promote the reorganization of GVCs, it will enhance China's manufacturing industry's positioning within the GVCs' division of labor, so that China's manufacturing industry can get out of the "low-end lock-in" dilemma. Theoretically, this paper contributes to the understanding of how the digital economy affects the GVC in manufacturing. Practically, it offers insights into fostering the digital economy and advancing the manufacturing industry's participation in the GVC.

Keywords: digital economy, global value chain, division of labor, manufacturing industry

1. Introduction

The digital economy, emerging as a novel economic paradigm, is fundamentally underpinned by the development of the Internet. The widespread adoption and rapid evolution of this new economic model have facilitated the rise of production globalization. By transcending traditional temporal and spatial constraints of industrial chains, the digital

economy has led to the fragmentation of the global division of labor into more specialized segments. Consequently, the fundamental unit of the international division of labor has shifted from finished products to specific stages within production processes or tasks, forming what is now known as the global value chain (GVC). Influenced by the digital economy, the GVC has emerged as the predominant form of

international division of labor. This transformation presents significant historical opportunities for developing countries like China (Wirkierman, A. L., 2023). Leveraging advantages such as low-cost labor, China has swiftly and comprehensively integrated into the GVC system. This integration has resulted in notable achievements that have captured global attention, including explosive growth in import and export trade, rapid expansion of industrial scale particularly in manufacturing, and sustained steady economic growth. The digital economy's influence on the formation and evolution of GVCs underscores its role in reshaping global industrial landscapes. For developing economies, the transition towards GVC participation offers not only avenues for economic advancement but also pathways for technological upgrading and structural optimization. Through active engagement in the digital economy, these countries can enhance their positions within the global market, fostering long-term sustainable development.

Given that an economy's profitability in global economic activities is closely tied to its participation in the GVC, such highly profitable industries are concentrated in high value-added segments. Developed countries, by leveraging rapid capital accumulation and technological innovation, firmly occupy higher positions in the GVC. Although China has gradually become the "world's manufacturing factory" after The Reform and Opening up, the manufacturing industry has traditionally occupied lower ends of the GVC. The lack of core competitive support and the status of being 'large but not strong' have emerged as drawbacks for China's manufacturing industry. Nevertheless, the digital economy has provided a strong impetus for economic growth and become an efficient way to promote the upgrading of the GVC within industrial. Meanwhile, manufacturing industry as a crucial component of global division of labor and a significant driver of global economic development, serves not only as the primary means by which countries participate in international trade but also as the core focus in the competition for trade benefits. If the technologies related to the digital economy are used to promote the reorganization of the GVC, they will improve the division of labor of the China's manufacturing industry's position in the GVC, with a view to liberating China's manufacturing industry from the "low-end

lock-in" dilemma (Zhang, E. Z., & Dai X., 2022).

In September 2016, the G20 Hangzhou Summit released the "Twenty-Nation Initiative for Development and Cooperation in the Digital Economy" that has served as a compass guiding countries in seizing digital opportunities, promoting industrial transformation and upgrading, and supporting economic growth. In the "Report of the 19th CPC National Congress", President Xi Jinping reiterated the importance of the Internet to human life and economic and social development, proposing that we should seize the new opportunities of the digital age, step up our infrastructure efforts, and make use of the Internet and big data to create a new momentum for economic recovery and cultivate new growth points for the economic development of society as a whole. At the start of 2022, China's State Council issued the "14th Five-Year Plan for the Development of the Digital Economy" which highlighted that the digital economy has become a key force in reshaping the world's value pattern, and re-emphasized the need to grasp the new opportunities for digital development, continue to strengthen the construction of digital infrastructure, improve the utilization rate of data elements, and accelerate the entry into the universal sharing stage of digital economic development. Currently, the digital economy has been performing outstandingly, driving the transformation and upgrading of traditional industries, and has been a stabilizer of China's economic growth and a catalyst for industrial structure upgrading (Chen, X. D., & Yang, X. X., 2021).

Based on the above background, this paper explores the relationship between the digital economy and China's manufacturing GVC position using the literature review method. Given the limited number of existing studies examining China's manufacturing GVC status from the perspective of the digital economy, this paper contributes to the body of knowledge on the digital economy and manufacturing GVCs, which helps to study the economic effects of digital economy. Additionally, it proposes targeted strategies to elevate China's manufacturing GVC status, aiming to strengthen the country's manufacturing industry within the GVC and promote its economic development towards high-quality growth.

The remainder of this paper is organized as follows: Section 2 presents a comprehensive

literature review, providing a foundation for understanding the existing research landscape. Section 3 delves into the mechanisms through which the digital economy influences the position of the manufacturing industry within the GVC. Finally, Section 4 synthesizes the key findings and offers targeted policy recommendations to support further development and integration.

2. Literature Review

Numerous academics have defined the digital economy. The specialized concept of digital economy was first proposed by Tapscott (1996), an American IT consultant. In terms of the definition of digital economy, the OECD defines digital economy as a production mode in which human production activities are transformed from atomic processing to information processing under the impact of emerging information technology (Wang, Z. X., Gao, T., & Wang, R. N., 2022). Zhang and Shen define the 'digital economy' as a set of economic activities that utilize digitized knowledge and information as key production factors, leverage a modern network as an important carrier, and harness the effective use of ICT as a significant driver for efficiency improvement and economic structure optimization (Zhang, B. C., & Shen, K. Y., 2018). Therefore, through the integration and technologization of the digital economy, it is possible to achieve adjustments and optimizations in the industrial structure, significantly enhancing production efficiency (Wei, D. M., Xu, Y., & Gu, N. H., 2023). This process also elevates the quality of economic development and injects additional momentum into economic growth (Wu, H. X., & Yu, C., 2022). Similarly, Shi also emphasized the role of digital economy in promoting high-quality economic development (Shi, Y., 2022). The view that digital economy is an economic form brought about by information technology and informatization has basically been recognized by academics (Rong, A. P., 2023).

The concept of "value chain" was first introduced by Michael Porter in 1985, who posited that interconnected value-adding activities within a firm constitute its value chain. Gereffi pioneered the concept of "global value chain", describing it as the production, processing, and distribution activities involved in the division of labor among countries within the context of economic globalization (Gereffi, G., 2018). He has also studied the value creation

and distribution issues arising from this phenomenon. With the burgeoning development of the digital economy, an increasing number of scholars are focusing on how international supply chains link economic activities at the global, regional, national, and local levels within the GVC framework (Grimes, S., 2023). Gong argues that competitive dynamics, market demand, technological advances, and policy factors are all external influences affecting the upgrading of manufacturing industries within the GVC division of labor (Gong, S. L., 2009). Furthermore, the GVC division of labor provides benefits such as access to competitively priced inputs, a broader selection, and economies of scale (Arora, K., 2023), thereby facilitating China's industrial transformation and upgrading (Lv, Y., & Zhang, H. T., 2023). However, China remains in a lower GVC position (Wen, Y., & Wen, S. H., 2023), which may lead to a middle-income trap, characterized by remaining in low-value segments of the value chain (Song, Y., Yu, C., Hao, L., & Chen, X., 2021). Although China's manufacturing industry holds a competitive advantage and even international competitiveness in certain areas, there is still a considerable gap compared to developed regions. Therefore, it is essential to leverage the technological upgrades spurred by the digital economy to gain greater control over the manufacturing GVC.

With the advent of the digital economy, the traditional mode of division of labor in the GVC has changed, and the modes and types of trade in products and services at each link in the GVC have also undergone significant transformations. The GVC is now characterized by individuality and intelligence, and the development of the digital economy is promoting the integration and upgrading of global industries. Enterprises should seize this opportunity to strengthen independent R&D and innovation and participate in the GVC by producing higher-value-added products. Song suggests that digital innovation, digital development, and the level of digital infrastructure can significantly enhance the position within the GVC (Song, H. T., 2021). As the digital economy develops, the level of intelligence and informatization in the manufacturing industry will be further enhanced, thereby improving manufacturing quality and supply chain efficiency, addressing

the bottlenecks faced by the manufacturing industry, accelerating its strategic transformation, and assisting China's manufacturing industry in moving towards the mid-to-high-end segments of the GVC (Guo, X. M., & Chen, H., 2023).

To sum up, there remains significant scope to explore the impact of the digital economy on China's manufacturing industry's position within the GVC. Building on existing research, this paper compares the level of development

and changes in China's digital economy from 2010 to 2019 with the position within the GVC of China's manufacturing industry over the same period. Furthermore, it conducts a theoretical analysis of the influence of the digital economy on China's manufacturing industry's position within the GVC, considering direct mechanisms, indirect mechanisms, and spatial spillover effects.

3. Mechanisms Analysis

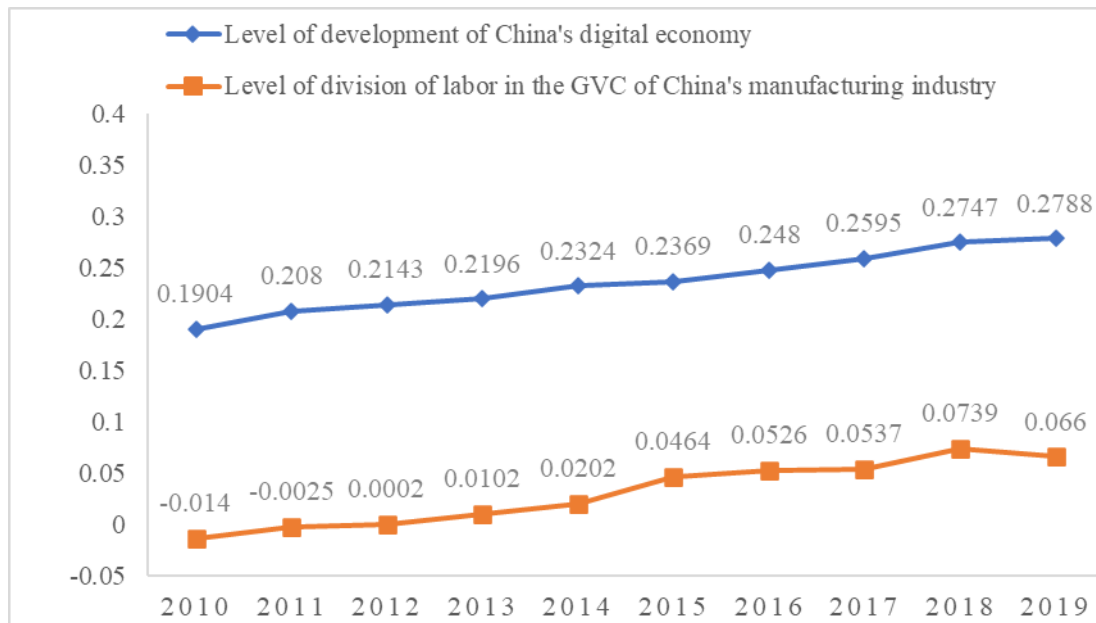


Figure 1. China's digital economy level and manufacturing GVC level, 2010-2019

Digital technology serves as the bedrock upon which the digital economy is built. Digital technologies include information and communications technology, artificial intelligence, IoT and cloud computing, which are pivotal in driving the evolution and expansion of the digital economy. The digital economy refers to economic activities involving production, distribution, circulation, and consumption facilitated by digital technologies. It encompasses digitized products, services, channels, and transaction methods. Through advancements in digital technology, the digital economy enables efficient information transmission, optimal data utilization, streamlined transactions, and effective market operations. These efficiencies stimulate economic growth and foster social progress. The rapid advancement of digital technology provides robust support for the digital economy, while the continuous expansion of the digital economy, in turn, fuels further development and

application of these technologies. This symbiotic relationship underscores the interdependence and complementarity between digital technology and the digital economy. Together, they construct a digitalized world that presents both unprecedented opportunities and new challenges. Digital technology and the digital economy are mutually reinforcing, each driving the other toward greater innovation and broader application. This dynamic interplay creates a fertile ground for economic development and societal advancement, shaping a future where digitalization plays an increasingly central role.

Figure 1 shows the development level of China's digital economy from 2010 to 2019 (Chen, W. G., Zhang, J. W., & Liu, B., 2023), as well as the level of division of labor within the GVC of China's manufacturing industry (Wang, D., 2022). As shown in Figure 1, the development level of China's digital economy has steadily improved since 2010. At the same time, the level of

division of labor within the global value chain of China's manufacturing industry reflects the trend of the digital economy, driven by rapid growth since 2010. The development speed of the two is almost the same, which strongly indicates the role of the digital economy in strengthening the division of labor in the global value chain of China's manufacturing industry.

3.1 Direct Impact Mechanisms

The digital economy has a direct impact on the global value chain through mechanisms such as reducing trade costs and upgrading industrial structure. Every link in the global value chain, from intermediate products to final products, generates costs that can be reduced through digital technology. By reducing these costs, the digital economy not only enhances trade value, but also elevates the position of manufacturing in the global value chain. Specifically, trade costs related to transportation, data information, market transactions, and institutional frameworks are greatly reduced. For example, the advancement of digital technology has overcome geographical barriers, strengthened marketization, and reduced the transportation costs of international trade. In addition, digital technology is in line with the trend of intelligence, improving transportation efficiency while significantly reducing costs. Asymmetric information — a key issue in the global value chain of manufacturing — has been alleviated through the free flow of data and timely exchange on a global scale, thereby improving the accuracy of information and reducing data related costs. In addition, the emergence of new digital platforms has simplified the organizational structure of enterprises, simplified management levels, and reduced coordination and marketing costs. From a policy perspective, the digital economy helps to adjust government policies, adjust the national system, and reduce institutional transaction costs. Therefore, lower policy costs give countries a comparative advantage in value creation, consolidating their position in the global value chain.

The development of the digital economy has accelerated the transformation and upgrading of China's manufacturing industry, cultivated new industries, and optimized the industrial structure. On the one hand, digital technology has enhanced traditional manufacturing operations, improving production efficiency and output. Advanced technology has reduced

various production costs, optimized resource allocation, and achieved comprehensive digital control. Enterprises generate a large amount of data during production and sales processes, which can be analyzed using digital tools to minimize operational errors. Real time monitoring and data analysis allow for timely identification of anomalies and risks, thereby reducing operational hazards. This technological integration provides strong support for the transformation of traditional manufacturing, where lower costs and higher efficiency enhance competitiveness and elevate its position in the global value chain. On the other hand, the digital economy has stimulated the emergence of new manufacturing industries characterized by effective supply-demand matching and advanced production models. The application of high-tech digital solutions has created an innovative production system located at the high value-added end of the global value chain, contributing to the overall rise of China's manufacturing industry in the global value chain.

In short, the development of the digital economy has enormous potential to enhance the position of China's manufacturing industry in the global value chain. The digital economy plays a key role in promoting the development of China's manufacturing industry by reducing transaction costs and promoting industrial upgrading. The cost reduction in transportation, information, market, and policy areas has created a favorable environment for the transformation of the manufacturing industry. In addition, the emergence of emerging industries and the adoption of advanced digital technologies help to increase added value and optimize industrial structure. Ultimately, these factors collectively elevated the position of China's manufacturing industry in the global value chain, driving economic growth and competitiveness on the global stage.

3.2 Indirect Impact Mechanism

The development of the digital economy has an indirect impact on the global value chain through the intermediary role of technological innovation. According to Schumpeter's theory of creative destruction, the advancement of digital technology has accelerated the transformation of traditional manufacturing, thereby increased product added value and accelerated industrial transformation. In this context, the technological intensity of the manufacturing process is

directly proportional to its position in the global value chain; Products characterized by high technological intensity often have higher added value, thus occupying a more advantageous position in the global value chain. On the contrary, products with lower technology intensity are associated with lower added value and corresponding lower position in the global value chain. The digital economy has promoted the improvement of product technology intensity, thereby increased added value and improved the positioning of the global value chain. This dynamic not only enhances the international competitiveness of enterprises, but also promotes economies of scale, while enterprises that fail to utilize digital technology may be marginalized in the global market.

In the era of globalization and international division of labor, the development and application of digital economy related technologies have significantly increased product added value, elevated the position of the global value chain, and enhanced international competitiveness. Developing countries typically have abundant labor resources and lower labor costs, often finding themselves at the low end of the global value chain. At the same time, developed countries with higher technological levels have hosted research and development activities by multinational corporations aimed at producing high value-added products. However, if developing countries can strategically invest in digital technology to promote innovation, they will greatly enhance their key technological capabilities. By combining these advances with cost advantages, developing countries can attract multinational corporations to relocate high value-added production activities. This transformation will enhance the added value and international competitiveness of products from developing countries, thereby strengthening their position in the global value chain. Therefore, strategically utilizing digital technology can bridge the gap between developed and developing countries in terms of technological maturity and economic value creation.

In short, the digital economy influences the division of labor in the global value chain by promoting technological innovation. By increasing technological intensity, digital technology has enhanced the added value of products and improved their position in the

global value chain. Enterprises that embrace digital transformation have gained competitive advantages and achieved economies of scale, while those that lag face potential elimination. For developing countries, utilizing digital technology for innovation provides a way to enhance their position in the global value chain. By attracting high value-added production activities from multinational corporations, developing countries can enhance their economic value creation and international competitiveness. Therefore, the digital economy is a catalyst for redefining the global industrial landscape, promoting fair participation and growth among different economies.

3.3 Spatial Spillover Effect

The digital economy uses emerging technologies such as the Internet and big data to greatly ease the geographical barriers of traditionally isolated enterprises. The reduction of spatial constraints enables enterprises in various regions to achieve interconnectivity and resource sharing, thereby expanding the scope and depth of regional economic connections. Enterprises can now collaborate more effectively, regardless of their physical location, creating a more integrated and dynamic economic environment. Technology spillovers are often limited by geographical proximity, but the limitations are relatively small, allowing regions to improve the efficiency of knowledge, technology, and information utilization. Therefore, these regions have generated spatial spillover effects, enhancing their position in the global value chain. By breaking down geographical barriers, the digital economy promotes wider access to resources and professional knowledge, thereby enhancing productivity and innovation capabilities.

In addition, the digital economy has facilitated the formation of development alliances among different market participants, including governments, research institutions, businesses, and educational institutions. These alliances promote closer connections and cooperation among stakeholders, facilitate resource sharing and complementary advantages. This collaboration has achieved technological synergy and innovation, resulting in significant regional spillover effects. Through cooperation, the surrounding areas can ensure lower production costs and higher service levels, enhancing the international competitiveness of regional products. This collaborative framework

has stimulated sustained growth in regional demand and elevated the position of manufacturing in the global value chain. The spatial spillover effect of this cooperation ensures that neighboring regions benefit from lower prices and higher quality services, driving overall economic development. Therefore, the digital economy not only enhances a region's position in the global value chain, but also strengthens its attractiveness to surrounding areas, making positive contributions to regional economic integration and growth.

From the perspective of economic geography, each element in the digital economy exhibits unique spatial differences. There is a clear positive correlation between the quantity and value of digital economy output and the degree and speed of its dissemination. The ability of the digital economy to transcend traditional spatial limitations means that it can have a positive impact on neighboring regions through spatial spillover. This impact manifests as spatial heterogeneity, with different regions experiencing varying degrees of economic impact based on their specific characteristics and connectivity. Therefore, the digital economy plays a crucial role in shaping the economic landscape by promoting regional cooperation and innovation. Its ability to generate positive spillover effects highlights the importance of understanding and utilizing spatial dynamics to achieve optimal economic outcomes. In summary, the spatial spillover effects of the digital economy are both positive and beneficial, improving regional economic performance and strengthening the position of manufacturing in the global value chain.

4. Conclusions

This paper focuses on analyzing how the development of the digital economy influences the GVC status of China's manufacturing industry and explores the theoretical mechanisms underlying this impact on the global supply chain position within the manufacturing sector. The main conclusions are as follows: first of all, from an overall perspective, the digital economy significantly promotes the upgrading of China's manufacturing industry within the GVC by reducing trade costs and fostering industrial structure upgrades. It has become a key driving force for enhancing China's manufacturing industry's GVC status in the new era, helping to break the "low-end lock-in" dilemma faced by

the industry. Secondly, Technological innovation plays a crucial intermediary role in the process through which the digital economy affects the GVC status of the manufacturing industry. The new production and manufacturing patterns generated by the digital economy substantially boost regional innovative investments, ultimately empowering the manufacturing industry to elevate its GVC status. Finally, the influence of the digital economy on the GVC status of the manufacturing industry exhibits spatial spillover effects. Not only does it enhance the GVC status of the manufacturing industry within a specific region, but it also drives improvements in neighboring regions, thereby promoting broader regional development.

The following are three policy recommendations based on this paper. First, efforts should be made to strengthen the construction of digital infrastructure and improve the overall level of information developing. Digital infrastructure serves as the fundamental guarantee for the digital economy's development, with perfect infrastructure supporting its sustainable growth. New businesses and models under the digital economy require robust infrastructure to ensure the smooth operation of economic activities. It is crucial to promote vigorously the popularization of mobile networks, the Internet, 5G, cloud computing, and other information and communication technologies. We must also strengthen the construction of new types of digital infrastructure, advancing the development of the IoT, promoting the integration of digital technology with traditional industries, and accelerating the establishment of a high-quality and trustworthy cornerstone for the digital economy. Additionally, it is important to expedite the building of cloud computing centers, enhance the deployment of big data platforms, and facilitate the timely completion of a multi-functional, intelligent, and integrated information infrastructure platform.

Secondly, the coordination of information and data openness should be enhanced, along with strengthened protection of intellectual property rights in digital technology. Under the premises of ensuring data security and privacy, government departments should integrate governmental information resources to promote the opening of information and data. This approach can bolster the momentum of digital economic development, elevate the level of

digital economic advancement, and enhance the operational efficiency across various links in the manufacturing value chain. By maximizing the utilization efficiency of public data owned by the government, more social and economic value can be explored. In the era of the digital economy, technological innovation outcomes and commercial data are crucial factors influencing its development. Given the significant losses caused by information leaks, ensuring the high-quality development of the digital economy necessitates improved judicial protection for intellectual property rights related to digital technology. Timely actions must be taken to halt infringements, and severe investigations should be conducted into intellectual property rights violations.

Thirdly, the integration of the digital economy with the manufacturing industry should be promoted. Manufacturing forms the backbone of China's national economy, characterized by a long history of development and a mature system. Digital technology significantly impacts traditional manufacturing, transforming standardized production modes, accelerating the incorporation of digital technologies into manufacturing processes, and advancing the integration of the digital economy with the manufacturing industry. It also encourages the convergence of digital technology with intelligent manufacturing. We should have a clear understanding of the direction of manufacturing development, concentrate our primary efforts on promoting R&D and innovation in key technological areas, continuously refine new manufacturing processes centered around digital technology, and gradually gain control over critical technologies. Furthermore, we should deeply implement intelligent manufacturing projects, expedite the popularization of intelligent manufacturing in key industries, promote industrial integration and cooperation, and facilitate interaction within the field of intelligent manufacturing.

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