ISSN: 2710-0170

Research on Digital Economy Driving High Quality Development of China's Manufacturing Industry

Junchen Ge[1], Shaoqing Ren[1], Deqin Chen[1], Shiyang Li[2]

[1] School of International Trade and Economics, Anhui University of Finance & Economics, Bengbu 233000, China

[2] School of Finance, Anhui University of Finance & Economics, Bengbu 233000, China

Abstract

With the profound changes in the global industrial economic situation, the industrial competition pattern is further adjusted, China's original reliance on the "demographic dividend" effect of the manufacturing industry expansion path is facing the challenge of low-end locking and marginalization, the urgent need to cultivate new kinetic energy. Get rid of the inherent low-cost competition and scale expansion mode, promote the digital transformation of the manufacturing industry, are the road to high-quality development of the manufacturing industry under the new development pattern. On the one hand, the digital economy has reconstructed the layout of the manufacturing industry chain in digital space and physical space, effectively unimpeded the domestic macrocycle; on the other hand, the digital economy can promote China's manufacturing industry to the high-end of the value chain, and win a larger profit space and the right to speak for the manufacturing industry to integrate into the international cycle. Therefore, under the new development pattern of internal and external double cycle, digital economy has become the new kinetic energy for the upgrading of China's manufacturing industry. This project combs through the domestic digital economy to drive the high-quality development of the manufacturing industry related literature, summarizes the economy to drive the high-quality development of the manufacturing industry measurement method, organizes the recent years of China's manufacturing industry development related research, consolidates the research foundation and expands the research perspective, constructs the "scale - structure", We construct a four-dimensional analytical framework of "scale-structure" and "circulation-external circulation" for the high-quality development of manufacturing industry, and explore the theoretical mechanism of digitalization-driven high-quality development of manufacturing industry. Through the use of econometric modeling methods to carry out empirical analysis of the digital economy driven manufacturing high quality, according to the empirical results, more scientific formulation of the digital economy driven China's manufacturing industry upgrading countermeasures recommendations.

Keywords

Digitization; High-quality Development of Manufacturing; Digital Economy; Technological Innovation.

1. Introduction

In recent years, the country to speed up the layout of digital transformation rhythm, the digital transformation of manufacturing enterprises pressed the "shortcut button", a systematic answer to the effect of digitalization on the high-quality development of the manufacturing industry, the mechanism, as well as the heterogeneity, the threshold effect of certain theoretical significance and practical significance. Dependent on the traditional factors of production

ISSN: 2710-0170

driven by the crude growth by the law of diminishing factor returns constraints power is diminishing, the study of digitalization for the high-quality development of the manufacturing industry power mechanism, in the period of premature de-industrialization of the manufacturing industry has to explore and discover the reality of the power of the new role. Theoretical and empirical tests also confirm that digitalization is a new engine for high-quality development of the manufacturing industry, which is mainly realized through the performance enhancement effect, the innovation empowerment effect and the global value chain upgrading effect. Further, through the analysis of region, industry, ownership, and scale characteristics, it indicates the direction of industrial policy and financial policy adjustment for the manufacturing industry to obtain high-quality development effect through digital economy. With the development of the digital economy, digital knowledge and information has become a key production factor penetrating into all walks of life, has become the new engine of global economic recovery, the real economy, especially the development of the manufacturing industry has played a leading role in supporting the effect of the digital economy has become a new engine to drive the high-quality development of the manufacturing industry. In the case of significant changes in the environment and pattern of manufacturing development, identify new economic growth points, tap new strategic opportunities to promote the high-quality development of China's manufacturing industry. Give full play to the factor-driven effect of the digital economy, turn data into the fourth type of production factors to penetrate and adjust the allocation of traditional factors such as labor, land, capital, etc., and enhance the efficiency of factor allocation.

2. Literature Review

2.1. Review of National Literature

Zhu Chunhong (2005) used a matrix model to prove that there is a strong correlation between the information technology industry and industrial structure upgrading. Wang Linsheng (2016) argues that the new round of information technology change represented by "Internet+" has become the most basic productivity for social and economic development, which can enhance the competitiveness of the manufacturing industry and promote the transformation and upgrading of the industrial development mode. Shi Dan et al. (2017) believe that the optimization and adjustment of the industrial structure of the manufacturing industry has become the core battlefield for boosting the quality, efficiency and upgrading of China's real economy Xiao Xu et al. (2019) verified the role of the digital economy in the optimization and upgrading of the industrial structure based on the theory of the value dimension. Cai Fang (2021) argued that the decline in the proportion of China's manufacturing industry is of a "precocious" nature. Chen et al. (2021) constructed a gray correlation entropy model to discover the promotion effect of digital economy on industrial structure. Cai Yanze et al. (2021) found that the digital economy can regulate the innovation environment to promote the transformation and upgrading of the manufacturing industry. Chen Qingjiang et al. (2021) argued that the essence of enterprise digital transformation is to optimize the spatial and temporal distribution of resources such as labor, capital or capital, and production materials, which are traditional factors of production, with the efficient flow of data, so as to achieve real-time sharing of information and efficient allocation of resources among enterprises, and to improve the level of digital transformation of focal enterprises.

2.2. Foreign Literature Review

Lee et al. (2009) found that digitization is a catalyst for industrial structure upgrading by measuring industrial relatedness. Since then, scholars have verified the driving effect of digital economy on manufacturing upgrading through empirical evidence as well as theoretical analysis.Manyika et al. (2011) found that the digital economy has a significant driving effect on

ISSN: 2710-0170

the transformation and upgrading of the manufacturing industry.Forman et al. (2012) argued that the learning effect of the enterprise can be accelerated to be formed and released, so that the enterprise's technological resources can be expanded horizontally and vertically in both directions. bi-directional expansion.Walker (2014) even regarded data as a key production factor for the transformation of the manufacturing industry.Giudice (2016) and Gaputo et al. (2016) argued that the rapid development of the Internet of Things (IoT) technology has successfully promoted the transformation and upgrading of the manufacturing industry.Bloom et al. (2014) argued that the extensive application of digital technology enables enterprises to build advanced technology at a lower cost to achieve rapid penetration of knowledge and information, and effectively shorten the communication time and collaboration cost between technology research and development teams.Chanias et al. (2019) argued that an enterprise's choice to achieve transformation and upgrading through informatization technology can be regarded as an enterprise carrying out digital transformation.

Comprehensive research on the relationship between the digital economy and the high-quality development of the manufacturing industry, we can find that academics have basically reached the following consensus: the digital economy can promote the high-quality development of the manufacturing industry by optimizing the allocation of resources, improving the innovation capacity, and changing the industrial model, etc.; the driving effect of the digital economy on the high quality of the manufacturing industry is not a simple linear trend; these studies have carried out comprehensive research from different perspectives, including the relationship, mechanism, and differences in the effect of the digital economy and high-quality development of the manufacturing industry. These studies have conducted more comprehensive research from different perspectives such as the relationship between the digital economy and the high-quality development of the manufacturing industry, the role of the mechanism and the difference in the effect of the role of different perspectives, but in the process of sorting out found that the current research is still deficient: because of the differences in the definition of the digital economy, different scholars in the empirical study of the selected indicators representing the level of development of the digital economy tend to be more one-sided, which may lead to the results of the study there are biases. Therefore, this project, in conducting research related to digital economy-driven high-quality development of manufacturing industry, refers to the current literature and national policy releases to sort out and standardize the digital economy measurement, construct a more comprehensive measurement system of digital economy development level to measure the development of the digital economy, and conduct research based on the results of this measurement to reduce the basic error.

3. Mechanisms of the Digital Economy for High-quality Development of the Manufacturing Sector

3.1. Optimize Productivity

The application of digital technology can help manufacturing enterprises realize the automation and intelligence of production lines and improve production efficiency. By introducing technologies such as the Internet of Things, big data and artificial intelligence, enterprises can monitor the operation of production lines in real time, obtain feedback on production data, and analyze and optimize it intelligently. This helps reduce production waste, lower costs and improve product quality, enhancing the market competitiveness of enterprises.

3.2. Improve Product Quality

The application of digital technology can help manufacturing enterprises improve product quality. Through the introduction of digital design and simulation technology, enterprises can conduct virtual experiments and simulation tests during the product development stage,

ISSN: 2710-0170

discover and solve potential problems in a timely manner, and improve product reliability and performance. At the same time, digital technology can also realize the fine management of the production process, real-time monitoring and optimization of products, improve product quality and customer satisfaction. At the same time, the application of digital technology can help manufacturing enterprises respond quickly to market demand. Through the introduction of digital marketing and supply chain management systems, enterprises can realize real-time monitoring and analysis of market demand, and timely adjust production and sales strategies to meet changes in market demand. This helps to improve the market response speed and flexibility of enterprises and enhance their competitiveness.

3.3. Promoting Innovation and R&D

The application of digital technology can help manufacturing enterprises to carry out technological innovation and research and development. Through the introduction of digital design and simulation technology, enterprises can conduct virtual experiments and simulation tests in the product development stage, shorten the product development cycle and reduce research and development costs. At the same time, digital technology can also promote the cooperation between enterprises and universities, scientific research institutions, etc., and promote the integrated development of production, learning and research. This helps to improve the technical level and innovation ability of enterprises and develop more competitive products.

3.4. Strengthening Industry Chain Synergy

The application of digital technology can help manufacturing enterprises realize information sharing and collaborative operations with suppliers, logistics providers and other enterprises upstream and downstream of the industrial chain. Through the introduction of supply chain management systems and technologies such as the Internet of Things, enterprises can interact with their partners in real-time information, collaboratively manage inventory, orders and other operations, and improve the synergistic effect and value-addedness of the entire industrial chain. This helps to improve the production efficiency and product quality of enterprises and enhance the competitiveness and stability of the whole industrial chain.

3.5. Reduction of Operating Costs

The application of digital technology can help manufacturing enterprises reduce operating costs. Through the introduction of digital management and intelligent energy management system, enterprises can realize the fine management of the production process, real-time monitoring and optimization management of energy consumption, and reduce operating costs. At the same time, digital technology can also help enterprises optimize supply chain management and reduce inventory costs and logistics costs. This helps to improve the profitability of enterprises and enhance their market competitiveness.

In summary, the application of digital economy plays an important role in improving the competitiveness of the manufacturing industry. By optimizing production efficiency, improving product quality, facilitating rapid response to the market, promoting innovation and R&D, strengthening industry chain synergy and reducing operating costs in various ways, digital technology provides the manufacturing industry with stronger competitiveness and market adaptability. In future development, it is necessary to further increase the support and investment in digital technology, promote the deep integration of the digital economy and the manufacturing industry, and provide stronger impetus for realizing the high-quality development of the manufacturing industry.

ISSN: 2710-0170

4. Empirical Analysis

4.1. Modeling

In order to examine the impact of the digital economy on manufacturing upgrading, the model is set as follows:

$$MA_{it} = \beta_0 + \beta_1 DE_{it} + \beta_2 \sum Control_{it} + \varepsilon_{it}$$

where i represents the region and t represents the year. MA represents the level of manufacturing upgrading and DE represents the level of digital economy development.$Control$ represents a series of control variables, mainly including the level of economic development (PGDP), government fiscal expenditure (GI), foreign investment (FDI) and financial development level (FIN).ε_{it} denotes the random perturbation term.

4.2. Selection of Variables

1.1.1. Explained Variables (MA)

Through in-depth research on the influencing factors of the transformation and upgrading of the manufacturing industry, and with reference to previous research results, we construct the index system of manufacturing upgrading and adopt the entropy value method to measure the level of upgrading of the manufacturing industry.

Table 1. Evaluation index system for the level of manufacturing transformation and upgrading

goal	Level 1 indicators	Secondary indicators	unit (of measure)	Direction of Indicators
Level of transformation and upgrading of the manufacturing sector	economic benefit	gross product of industry	billions	forward
		Energy consumption per unit of GDP	Tons of standard coal/$10,000	negative direction
		Electricity consumption per unit of GDP	Kilowatt-hours/million dollars	negative direction
		labor productivity	Billions of dollars/person	forward
	innovation capacity	Level of investment in research	%	forward
		Number of active patent inventions	classifier for clothes, luggage, decorations; piece of work; a matter, an event	forward
	Green development	Total industrial wastewater discharge	tons	negative direction
		Industrial sulphur dioxide emissions	ton (loanword)	negative direction

ISSN: 2710-0170

1.1.2. Explanatory Variables (DE)

This paper constructs a digital economy indicator system from two aspects, namely, Internet development and digital financial inclusion, and adopts the entropy value method to measure the level of digital economy development.

Table 2. Indicator system for the level of development of the digital economy

Level 1 indicators	Secondary indicators
Internet penetration	Internet users per 100 population
Internet-related outputs	Telecommunications revenue per capita
Number of mobile Internet users	Mobile Internet users per 100 population
Number of Internet-related workers	Percentage of employees in computer services and software
Digital inclusive financial development	Digital Inclusive Finance in China

1.1.3. Mediating Variables

Innovation capacity (INN): The impact of the innovation drive is crucial in the process of upgrading and developing the manufacturing sector. It is therefore measured by the indicator of the number of R&D personnel.

1.1.4. Control Variables

Level of economic development (PGDP): measured by GDP per capita; government fiscal expenditure (GI): measured by local fiscal and general public budget expenditures; foreign investment (FDI): measured by real foreign direct investment; and level of financial development (FIN): measured by loan balances of financial institutions.

4.3. Data Sources

The data in this paper come from the China Urban Statistical Yearbook and the statistical bulletin of each prefecture-level city. The descriptive statistics of the main variables are analyzed as shown in the table:

Table 3. Descriptive statistics of variables

	sample size	mean value	(statistics) standard deviation	minimum value	maximum values
MA	130	0.252	0.183	0.0720	0.888
DE	130	0.137	0.133	0.0030	0.849
INN	130	9.800	1.388	7.9280	13.15
FIN	130	8.386	1.216	6.5600	13.66
PGDP	130	10.76	0.485	9.9710	12.14
FDI	130	11.45	1.314	8.2350	14.70
GI	130	6.456	0.916	5.0600	8.919

4.4. Empirical Results

The table shows the results of the benchmark regression of the digital economy on manufacturing upgrading. From the results in the table, most of the variables passed the significance test. The goodness of fit of the model is 0.899, indicating that 89.9% of the changes in the explanatory variables can be explained by the variables listed in the model, and the fit of the model is high. Specific analyses of the benchmark regression results in the table are presented below:

1.1.5. The Impact of the Core Explanatory Variable "Digital Economy" on Manufacturing Upgrading.

The sign of the estimated coefficient of the level of development of the digital economy is positive and the p-value is 0.038, which passes the test of significance at the 5% level, and the

ISSN: 2710-0170

development of the digital economy has a significant positive impact on the level of upgrading of the manufacturing industry. The coefficient of influence of digital economy is 0.175, which is larger compared with other variables, and its meaning is that when other circumstances remain unchanged, every unit increase in the digital economy index, the manufacturing industry upgrading index will increase by 0.175 units, which has been verified that the digital economy has positively promoted the upgrading of the manufacturing industry, and injected a strong impetus into it.

Table 4. Benchmark regression results

MA	Coef.	St.Err	T-value	P-value	Sig.
DE	0.175	0.083	2.10	0.038	**
FIN	0.006	0.024	0.28	0.784	
PGDP	0.015	0.022	0.69	0.494	
FDI	0.026	0.010	2.72	0.007	***
GI	0.118	0.024	4.95	0.000	***
Cons	-1.046	0.189	-5.53	0.000	***
R-squared	0.899	Numberofobs	130.000		
F-test	219.788	Prob>F	0.00		
Akaikecrit.(AIC)	-360.211	Bayesiancrit.(BIC)	-343.016		

1.1.6. Impact of Control Variables on Manufacturing Upgrading

According to the regression results in Table 4, the estimated coefficient of per capita GDP (PGDP) is 0.015, with a p-value of 0.494, which has not been tested for significance. The possible reason is that economic development provides the necessary support for the transformation and upgrading of the manufacturing industry, but the problem of China's manufacturing industry being large but not strong is still prominent, thus failing to promote the transformation and upgrading of the manufacturing industry. The impact coefficient of government fiscal expenditure (GI) reaches 0.1118 and is significant at the 1% level. In the Beijing-Tianjin-Hebei region, there is a significant positive correlation between government investment in manufacturing and its upgrading. In the process of enterprises realizing the transformation and upgrading of the manufacturing industry, the guidance and support of the government is indispensable, because the manufacturing industry, as an important part of the real economy, plays a crucial role in the development of enterprises. Under the premise of keeping other conditions unchanged, the government's assistance is directly proportional to the upgrading and development of the manufacturing industry, i.e. the greater the government's assistance, the more effective it is in promoting the development of the manufacturing industry.

The regression coefficient of foreign direct investment (FDI) indicates that FDI has a positive effect on the level of manufacturing upgrading. After 1% significance test, the coefficient value is 0.026, indicating that FDI has a significant boosting effect on the development of manufacturing upgrading. Due to its unique geographic location, the Beijing-Tianjin-Hebei region has attracted a large influx of foreign investment, played the advantages brought by foreign direct investment, optimized the allocation of resources, and promoted the upgrading of the manufacturing industry. The impact coefficient of the level of financial development (FIN) is 0.006, which does not pass the significance test. The possible reason is that although financial development can provide more abundant financial support for enterprises, the investment in high and new technology is insufficient, so the impact on the upgrading of the manufacturing industry is not significant.

ISSN: 2710-0170

5. Policy Recommendations

Strengthen the top-level design and improve the policy system. Formulate policies related to the integration and development of digital economy and manufacturing industry, clarify the development direction and objectives, improve the relevant policy system, and guide and promote the deep integration of digital economy and manufacturing industry. Strengthen the construction of digital infrastructure. Increase investment in digital infrastructure to enhance the support capacity for the development of the digital economy. At the same time, it is necessary to promote the digital transformation of manufacturing enterprises and improve their digitalization level.

Promoting the innovative development of the digital economy. Encourage and support enterprises, colleges and universities and scientific research institutions to carry out innovative research and development in the field of digital economy, and promote the integration of digital economy and manufacturing industry. At the same time, it is necessary to focus on introducing and cultivating digital economy talents and improving talent support capacity. Strengthen inter-regional digital economy cooperation. Make good use of the advantages of digital economy development in various regions, strengthen inter-regional digital economy cooperation, establish more projects like "East Counts, West Counts" to integrate resources and divide work, maximize the data advantages of the digital economy, and further accelerate the pace of high-quality development of the manufacturing industry.

Improve the enterprise innovation environment and resource support. On the one hand, it is necessary to stimulate entrepreneurial activities to significantly promote the high-quality development of the manufacturing industry, and to attract and encourage talents to devote themselves to entrepreneurial activities through policies such as financial support and supporting public infrastructure; on the other hand, it is necessary to accelerate the digital transformation of government affairs to create a service-oriented government, and to improve the management efficiency and governance capacity. Play the role of industry associations and intermediary organizations. Industry associations and intermediary organizations can play an important role in the integrated development of the digital economy and manufacturing industry. For example, they can organize inter-enterprise exchanges and cooperation to promote information sharing and resource integration; provide consulting services and technical support to help enterprises solve problems in digital transformation; and carry out training and publicity activities to improve the digital literacy and skill levels of enterprises and employees. Strengthen data security and privacy protection. While promoting the integration and development of the digital economy and manufacturing industry, it is important to emphasize data security and personal privacy protection. Establish a sound data security management system and privacy protection system to ensure data security and compliance.

In conclusion, enhancing the digital economy for the development of the manufacturing industry requires multifaceted measures and efforts. All parties, including the Government, enterprises, industry associations and intermediary organizations, should strengthen cooperation to jointly promote the development of the digital economy and provide strong support for the high-quality development of the manufacturing industry.

Acknowledgments

This work is supported by 2023 National Undergraduate Innovation and Entrepreneurship Training Program, Project number: 202310378083.

ISSN: 2710-0170

References

[1] HU Xiaomei,LI Jie,CHEN Ding et al. Impact of digital economy on industrial upgrading of manufacturing industry in Yangtze River Delta region[J]. Journal of Qujing Normal College,2023, 42(06):69-74.

[2] Zhao Qian. Research on the role mechanism of digital economy on the transformation and upgrading of manufacturing industry in Henan Province[J]. Henan Agriculture,2023,(33):45-47.

[3] Fu Meixin,Lu Jiayi. Research on the impact of digital economy development on manufacturing upgrading in Beijing-Tianjin-Hebei region[J]. Business Economy,2023,(12):23-26.

[4] Zhou Xi. Research on the impact and mechanism of digital economy on the green development of manufacturing industry[J]. Nanjing Social Science,2023,(11):67-78.

[5] GUO Chaoxian. Evolution of industrial organization in the era of digital economy: trends, characteristics and effects[J]. China Rural Economy,2023,(10):2-25.

[6] Jiao Yunxia. Mechanism, dilemma and development path of digitalization-driven manufacturing upgrading[J]. Price Theory and Practice,2023,(05):14-18+112.

[7] Dong Li. Research on the resilience enhancement of manufacturing industry chain driven by digital economy[D]. Jilin University,2023.

[8] Zhao Xueqin. Research on the Influence Mechanism of Digital Economy on the Performance of Manufacturing Enterprises [D]. Nanchang University,2023.

[9] Cai Yanze. Research on the impact of digital economy on the high-quality development of manufacturing industry [D]. Shihezi University,2023.