

Research on the Regional Path of Digital Economy Promoting Manufacturing Transformation and Upgrading: Based on the Analysis of Typical Models in the Yangtze River Delta

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Received: 12 April 2026; Accepted: 5 May 2026; Published: 21 May 2026

Abstract:

How digital technology empowers the transformation and upgrading of the manufacturing industry has become a hot topic of social concern. This article selects the Yangtze River Delta Economic Zone, which is undergoing a deep development of digital transformation, as the research object. It systematically studies and analyzes the historical evolution, development path, and typical models of its manufacturing industry transformation and upgrading, and summarizes the experience to provide reference for other manufacturing enterprises to achieve high-quality development.

Keywords:

Digital Economy, Manufacturing Transformation, Gradient Cultivation, Cluster Development

1. Introduction

Currently, the digital economy has become the core driving force for economic development. According to a report by the China Academy of Information and Communications Technology, the scale of China's digital economy has reached 59.2 trillion yuan in 2024, accounting for 43.8% of GDP [1]. The booming development of the digital economy will become increasingly important in the future development pattern.

Manufacturing is an important pillar of the national economy and a core area for the development of China's real economy. According to data from the National Bureau of Statistics, the added value of China's manufacturing industry will reach 34.7 trillion yuan in 2025, accounting for 25% of GDP. China's manufacturing industry has maintained the world's largest scale for 16 consecutive years. However, with the continuous rise of production costs, the increasing constraints of green and low-carbon, and the accelerated restructuring of the international industrial chain, the manufacturing industry is facing profound pressure for transformation and upgrading.

The Yangtze River Delta Economic Zone has a strong industrial foundation and an active innovation ecosystem, and has become an advanced and demonstration zone for the digital transformation of China's manufacturing industry. By 2025, the Yangtze River Delta Economic Zone will have 26 national level advanced manufacturing clusters and 282 companies listed on the Science and Technology Innovation Board. According to the "Digital Yangtze River Delta Development Report (2025)", the scale of the artificial intelligence industry in the Yangtze River Delta accounts for one-third of the country's total, the production of integrated circuits accounts for 50% of the country's total, the scale of the data industry accounts for 23% of the country's total, the scale of excellent intelligent factories accounts for one-quarter of the country's total, the scale of intelligent computing power is leading in the country, and the level of digitization continues to lead. After more than a decade of development, the digital transformation of the manufacturing industry in the Yangtze River Delta Economic Zone has achieved significant results, providing valuable experience for manufacturing enterprises to transform and upgrade [2].

2. The Development History of Digital Transformation in the Yangtze River Delta Economic Zone

According to the Outline of the Development Plan for Regional Integration of the Yangtze River Delta, the Yangtze River Delta Economic Zone mainly refers to the three provinces and one city along the Yangtze River, including Zhejiang Province, Jiangsu Province, Anhui Province, and Shanghai City, with a total area of 368000 square kilometers and a total of 27 cities [3]. The digital transformation of the Yangtze River Delta Economic Zone began to sprout from Shanghai's layout of high-tech industrialization in 2008. After more than a decade of development, it has achieved tremendous results and become a demonstration zone for digital transformation of China's manufacturing industry. Looking at the process of digital transformation and development in the Yangtze River Delta Economic Zone, it can be divided into four stages: the embryonic stage, the exploratory stage, the acceleration stage, and the leap stage.

2.1. The budding period of digital transformation (before 2016)

In response to the national opinions on accelerating the development of the information industry, the Yangtze River Delta Economic Zone focuses on strengthening the construction of information infrastructure, and the software and e-commerce industries are flourishing. With the development of new technologies such as big data, cloud computing, the Internet of Things, and blockchain, the manufacturing industry has widely adopted digital applications, mainly focusing on the construction of internal information systems within enterprises.

2.2. Exploration period of regional integration planning (2016-2019)

In 2016, Shanghai focused on promoting the integration of manufacturing industry and the Internet, innovative development of industrial Internet, and fully promoted the digital transformation and upgrading of manufacturing in Shanghai. Jiangsu is continuously accelerating its industrial intelligent transformation and digital transformation pace. In 2018, the Ministry of Industry and Information Technology released the Construction Plan of the Yangtze River Delta Industrial Internet Integration Development Demonstration Zone, the Yangtze River Delta Economic Zone established the country's first industrial Internet integration demonstration zone,

and the industrial Internet integration of the Yangtze River Delta has become a national strategy.

2.3. Benchmarking and System Promotion Acceleration Period (2020-2022)

In 2020, Shanghai will launch the “Industrial Endowment to Shanghai” initiative, take the lead in the layout of industrial Internet, implement the innovative development of industrial Internet, and promote the integration of manufacturing industry and the Internet; Zhejiang is building a hierarchical cultivation system for factories, integrating the development of the “industrial brain+future factory” model, and creating a benchmark enterprise for intelligent development. Jiangsu is accelerating the transformation of industrial intelligence and focusing on building intelligent manufacturing demonstration factories. The number of “lighthouse factories” is leading in the country. In 2021, the “Yangtze River Delta Enterprise Digital Transformation Public Service Platform” will be fully launched to provide digital transformation public services and initially form a regional collaborative mechanism for digital transformation.

2.4. Differentiated development and collaborative linkage leap period (2023 present)

Jiangsu has implemented three major actions in the manufacturing industry, namely “smart transformation”, “digital transformation”, and “networking”, to promote the digitization of manufacturing factories, the numerical control of key processes, and the digitization of management in key enterprises. The high-quality development index of the manufacturing industry has been ranked first in the country. Shanghai continues to improve its information technology and big science infrastructure, promote regional digital transformation empowerment, advance the intelligent construction of industrial parks, focus on leading enterprises, build a multi-level comprehensive promotion model, and cultivate the number of national level intelligent factories, ranking first among cities in China. Zhejiang segmented industries, developed application scenarios and business modules for characteristic industrial clusters, built an industrial brain, integrated digital technology, iterated numbers, models, and experiences, created future factories, and achieved the dual wheel drive of “industrial brain+future factory” for digital transformation of manufacturing industry. Anhui is accelerating its pursuit, driven by both computing power and scenarios, to promote the digital transformation of the manufacturing industry.

Looking at the process and achievements of digital transformation of the manufacturing industry in the Yangtze River Delta Economic Zone, after more than ten years of development, the Yangtze River Delta Economic Zone has built a differentiated collaborative pattern with strong foundation in Shanghai, heavy manufacturing in Jiangsu, excellent scene in Zhejiang, and computing power in Anhui, created an advanced manufacturing cluster alliance, built a supply chain and industrial chain collaboration network, and built a gradient cultivation system for intelligent factories, forming a typical model of digital transformation with exemplary significance.

3. The Core Path and Effectiveness of Digital Transformation and Development of Manufacturing Industry in the Yangtze River Delta Economic Zone

Based on the development process and achievements of digital transformation in the manufacturing industry of the Yangtze River Delta Economic Zone, extract the specific path of digital transformation for manufacturing enterprises.

3.1. The path of “benchmark guidance gradient cultivation”

The Yangtze River Delta Economic Zone has a large number of enterprises with rich levels of scale. In the process of digital transformation and upgrading of manufacturing enterprises, a gradient cultivation path represented by “digital workshop intelligent factory future factory leading intelligent factory” has gradually formed. The gradient cultivation path divides enterprises into different levels, establishes benchmark enterprises at each level, promotes digital transformation of core production processes, strengthens system integration and collaboration, creates regional industry benchmarks, leads enterprises at different levels to advance step by step, and achieves an overall leap from single point digitization to global manufacturing capability leadership.

By the end of 2025, outstanding achievements have been made in the digital transformation of manufacturing enterprises in the Yangtze River Delta Economic Zone, with a total of over 35000 basic level intelligent factories built; More than 7000 advanced intelligent factories; More than 230 outstanding intelligent factories; There are over 15 navigation level intelligent factories.

3.2. Platform Empowerment Path

Relying on the industrial Internet in the Yangtze River Delta Economic Zone, we will consolidate the technological base for the digital transformation of manufacturing enterprises. Focusing on industry segmentation, building an industrial brain to play a central role in the industry, and accurately solving the problem of scene adaptation. This forms a dual wheel driven platform empowerment path of “infrastructure+industry brain”, achieving the organic unity of common technology support and personalized scenario requirements, and jointly building a complete platform ecosystem.

According to the “double crossing” list of the Ministry of Industry and Information Technology in 2025, the Yangtze River Delta Economic Zone has cultivated more than 20 national “double crossing” industrial Internet platforms, accounting for nearly one third of the total number in China. According to data from the Zhejiang Provincial Department of Economy and Information Technology, Zhejiang Province has built a total of 56 industrial brains, more than 600 application scenarios, and served nearly 150000 enterprises.

3.3. Chain collaborative path

Fully leverage the agglomeration advantages of the industrial chain and supply chain, with the chain owner enterprise as the core, to drive the overall digital transformation of upstream and downstream enterprises. Chain owners establish technical standards, output digital capabilities and order resources, and promote upstream and downstream enterprises to achieve digital transformation through

collaboration. The chain collaboration path, led by leading enterprises, helps small and medium-sized enterprises integrate into the industrial digital system at low cost, achieving a leap in industrial chain collaboration efficiency and capabilities.

As of June 2025, the Yangtze River Delta region has formed 26 national level advanced manufacturing clusters, accounting for 32.5% of the total number in the country [4]. In June 2025, the Yangtze River Delta Economic Zone will establish the Yangtze River Delta Manufacturing Cluster Alliance, which will build a collaborative network of industrial clusters on a larger scale.

3.4. Differentiated collaborative development path

The three provinces and one city in the Yangtze River Delta Economic Zone have different resource endowments, economic foundations, and development models, and have formed distinctive digital transformation routes for the manufacturing industry in the tide of the digital economy. Shanghai is based on technological resources, strengthening infrastructure construction and high-end leadership. Jiangsu fully leverages the demonstration effect of the “lighthouse factory” to promote the large-scale application of digital transformation. Zhejiang focuses on the construction of industrial brain and strives to empower the digital transformation of small and medium-sized enterprises. Although Anhui started relatively late, it prioritizes the development of computing power to achieve leapfrogging and catching up. In the process of digital transformation and development, the three provinces and one city rely on their respective advantages to jointly build a differentiated and coordinated development pattern with complementary functions and overall optimization.

On the basis of differentiated development, the overall synergy effect of the Yangtze River Delta region produces a cumulative effect. According to the “Digital Yangtze River Delta Development Report (2025)”, the added value of the digital economy in the Yangtze River Delta Economic Zone has exceeded 12 trillion yuan, and the scale of the data industry accounts for 22.6% of the national total [5]. Among them, the scale of the artificial intelligence industry in the Yangtze River Delta accounts for one-third of the country’s total, the scale of the integrated circuit industry accounts for more than 40% of the country’s total, and the production of new energy vehicles accounts for 38% of the country’s total.

4. Typical Model of Digital Transformation and Development of Manufacturing Industry in the Yangtze River Delta Economic Zone

After years of exploration and practice, the Yangtze River Delta Economic Zone has continuously explored the path of digital transformation and has formed three typical models.

4.1. Gradient cultivation mode

The Yangtze River Delta Economic Zone is promoting the digital transformation of manufacturing industry according to local conditions, and has developed distinctive gradient cultivation paths. Among them, the gradient system of “Digital Factory Intelligent Factory Future Factory” in Zhejiang Province is the most representative. The Yangtze River Delta Economic Zone has effectively integrated the digital transformation practices of manufacturing enterprises with the national four level gradient cultivation system for intelligent factories, and established a “benchmark

leading gradient cultivation” digital transformation model. By leveraging the demonstration effect of benchmark enterprises, leading industrial enterprises to accelerate the pace of digital transformation, and implementing differentiated cultivation for enterprises at different levels, we aim to promote the deepening development of digital transformation.

4.2. The “Industrial Brain+Intelligent Factory model

Private enterprises in Zhejiang Province are active, with a large number of small and medium-sized enterprises, and have taken the lead in proposing the “industrial brain+intelligent factory” model. The industrial brain gathers industry data, technological models, and business components to provide specialized and scenario based digital solutions for industrial chain enterprises. As a digital technology application terminal, smart factories achieve digitalization and intelligence of the entire production process with the empowerment of the industrial brain. Accumulate data resources and experience models during the operation of smart factories, and provide feedback to the industry brain. The dual empowerment of the two forms a collaborative mechanism of “brain empowerment+factory implementation”.

4.3. Cluster development model

The Yangtze River Delta Economic Zone is economically active, with highly concentrated manufacturing industries, dense industrial clusters, and mature industrial and supply chain systems. In the process of digital transformation in the manufacturing industry, the Yangtze River Delta is exploring the formation of a dual collaborative cluster development model of “chain collaboration+regional collaboration”, effectively reducing the threshold and cost of enterprise transformation, promoting the overall digital transformation of the industrial and supply chains, and improving labor productivity. Chain collaboration focuses on internal collaboration within the industrial chain, building a supply chain collaboration network with the chain owner enterprise as the core, replicating and extending digital capabilities upstream and downstream, and improving the matching rate and collaboration efficiency of the industrial chain. Regional collaboration mainly focuses on regional cooperation, building public service platforms, promoting industrial joint innovation, and striving to cultivate advanced manufacturing clusters with global competitiveness.

5. Conclusion and Policy Suggestions

5.1. Conclusion

Looking at the digital transformation path, mode, and development trend of the manufacturing industry in the Yangtze River Delta Economic Zone, we can see that the transformation of the manufacturing industry is accelerating comprehensively, presenting characteristics of iterative upgrading from digitization to intelligence, from chain collaboration to industrial agglomeration, and gradually evolving into a new development paradigm driven by innovation. The digital transformation of the manufacturing industry in the Yangtze River Delta Economic Zone is rapid and comprehensive, but it still faces many challenges. Firstly, the similarity of industries in different regions is high, and there are issues of homogenization and redundant construction. Secondly, some industrial clusters or chains lack resilience and lack strong chain owners and core key technological support. Finally, the education

system's talent cultivation is disconnected from industry demand, and there is a lack of professionals in various industries who can implement the digital transformation of "AI+manufacturing".

5.2. Policies and Suggestions

5.2.1. Coordinate the layout of future industrial tracks and build a new pattern of differentiated and coordinated development

Digital transformation is the core lifeline of manufacturing development, and the speed and mode of digital transformation determine the level and quality of manufacturing development. To develop the manufacturing industry in various regions, the first step is to establish an industrial layout coordination mechanism at the regional level, fully considering the development foundation and resource endowment. Based on the existing mature supply chain and industrial chain, the industrial layout should be coordinated and coordinated to avoid redundant construction and homogeneous competition. Actively absorbing the beneficial experience of the Yangtze River Delta Economic Zone, building a differentiated development system, achieving cross regional joint research and coordinated operations, and constructing a new pattern of future industrial development.

5.2.2. Promote the gradient cultivation mode of intelligent manufacturing, create benchmark enterprises, and improve industrial resilience

In 2024, the Ministry of Industry and Information Technology and six other ministries jointly launched the intelligent factory gradient cultivation action, building a four level cultivation system of "basic level advanced level excellent level leading level" [6]. This move will stratify manufacturing enterprises according to their degree of digital transformation and transformation. Manufacturing enterprises should adapt to local conditions, rapidly develop in their respective tiers, focus on digital transformation and transformation, improve digital efficiency and labor productivity, and enhance the resilience of the industrial chain. Local governments provide more policy and financial support to benchmark enterprises in the digital transformation industry, guiding them to fully leverage their leading demonstration effects, output modular digital transformation solutions to small and medium-sized enterprises, and drive the coordinated upgrading of the industrial chain.

5.2.3. Improve the digital talent support system and solve the problems of talent mobility and skill deficiency

The quantity and quality of talents in the Yangtze River Delta Economic Zone are higher than the national average, but the talent reserve still cannot meet the needs of digital transformation in the manufacturing industry. To establish a digital talent support system, the first step is to improve the mechanism of school enterprise integration, broaden the channels for talent flow, strengthen communication and cooperation between universities, research institutes, and manufacturing enterprises, and promote the transformation and implementation of scientific research achievements. Secondly, promote the integration of the education system with the industrial structure, combine changes in industrial development and talent demand, reshape the skill structure of various professional talents, and cultivate high-quality skilled talents with digital literacy.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

Funding

This work was supported by General Project of Humanities and Social Sciences in Shandong Province: “Research on the Mechanism and Path of Empowering High Quality Development of Shandong Manufacturing Industry with Digital Economy”.

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