A Typical Case Study on the Coupling of Industrial Digitization and Digital Industrialization Promoted by the "Three Cycles" Closed-loop System

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Abstract: The development of the digital economy is an inevitable choice for high-quality development at present. The digital economy relies on the coupling of industrial digitization and digital industrialization. Industrial digitalization refers to the transformation and upgrading of traditional industries in an all-round and full chain way by using modern information technology (such as big data, artificial intelligence, and industrial Internet). The core is "empowerment," that is, digital technology' empowers' the real economy. Digital industrialization refers to the development of digital technology into new industries and the formation of industrial clusters through market-oriented operations. The core is "industrialization", which means that digital technology itself has become a new growth point for the economy. This article aims to summarize empirical conclusions on the coupling of industrial digitization and digital industrialization by analyzing typical cases of regional development in China.
Keywords: Industrial digitalization; Digital industrialization; Coupling; Typical cases

1. Introduction

In 2024, the added value of core industries in the national digital economy will be 1.40891 trillion yuan, accounting for 10.5% of GDP. The high-quality development of the digital economy relies on the integration of industrial digitization and digital industrialization. Industrial digitization provides application scenarios for the digital economy, while digital industrialization provides technical support. The development of the digital economy relies on the highly closed-loop coupling of the two. Chen et al. (2022) used the coupling coordination degree model to measure the coupling between industrial digitization and digital industrialization in Jiangsu Province, and found that the overall level of coupling degree in Jiangsu Province is not high, with a trend of increasing year by year [1]. Tang et al. (2023) stated that digital coupling can empower high-quality urban development through three intermediary channels: entrepreneurial activity, talent gathering, and financial development [2]. Li et al. (2023) stated that the level of digital economy and high-quality development in China is constantly on the rise, and the former is generally lower than the latter, with a lower level of digital industrialization than industrial digitization [3]. Qi et al. (2024) found that digital industrialization and industrial digitization positively affect the economic growth efficiency of neighboring regions through spatial spillover effects [4]. Liu et al. (2024) proposed that In the Chinese eastern region, industrial digitalization promotes the improvement of both stages and overall

efficiency, while digital industrialization does not have a significant impact. In the central region, digital industrialization and industrial digitalization have significant positive impacts on both overall efficiency and the efficiency of achievement transformation, but have no impact on research and development. In the western region, digital industrialization inhibits the overall transformation efficiency, and industrial digitalization does not have a significant impact on the overall efficiency or the efficiency of each stage [5]. Ma et al. (2024) believe that promoting the coordinated development of "digitalization and industrialization" in the digital economy requires combining the value transformation of data elements with the reshaping and upgrading of digital and traditional industries [6]. Yi et al. (2025) proposed that while ensuring the continuous optimization of digital facilities in core cities and economic belts in the eastern region, efforts should be made to shift the focus of construction towards the central and western regions and remote areas [7]. Tang et al. (2025) believe that the industrialization of digital technology provides technical support and solutions for the transformation of traditional industries, while the digitization of industries offers universal application scenarios for general digital technologies, forcing digital technology innovation [8]. Su (2025) found through research that China's industrial digitalization can simultaneously promote economic, green, coordinated, and shared development, while the impact of digital industrialization on coordinated development is not significant [9]. Si et al. (2025) believe that China has opened up policy paths by ensuring the implementation of safeguard systems for digital industrialization and industrial digitalization policies through the valorization of data, digital governance, and the integration of educational and technological talents [10].

Existing research rarely conducts case analysis and experience summaries on the coupling of industrial digitization and digital industrialization, which provides room for the writing of this article.

2. Suzhou's coupling model of "dual technology collaboration and integration of data and reality"

2.1. Based on the manufacturing industry, strengthen the digital brand effect

Suzhou has nearly 200000 industrial enterprises, covering nearly 50 industrial categories. The digital upgrading effect is obvious, and intelligence + digitalization has become the goal pursued by enterprises. Firstly, construct several "bridgehead" factories. Having brands such as Bosch Automotive, Procter & Gamble, and Johnson & Johnson, is gradually forming a brand + benchmark effect. Build a "digital + intelligent" production site. Vigorously promoting the construction of intelligent workshops, a large number of provincial and municipal intelligent demonstration workshops have been built. Strengthen the empowering effect of platform production. We have cultivated cross-industry and cross-domain platforms represented by Huawei Cloud, Ziguang Cloud, XCMG Information, etc. At the same time, a number of industry-level platforms such as Hengtong Optoelectronics and Shengli Precision have emerged, providing "cloud-based data empowerment" services for small and medium-sized enterprises. Secondly, the characteristics of digital clusters are significant. Gradually forming competitive digital clusters, including electronic information technology, biomedicine, and textiles, all have strong competitiveness nationwide and even worldwide. Once again, strengthen the supportive effect of policies. Suzhou has introduced a series of policies, such as the "Suzhou Manufacturing Industry Intelligent Transformation and Digital Transformation Action Plan", which has greatly stimulated the transformation drive of enterprises.

2.2. Seize new tracks, build a "Digital Suzhou" highland, and actively promote the landing of digital industrialization

Suzhou is no longer satisfied with just being a "world factory" and is making every effort to build a digital industry cluster with international competitiveness. At present, the competitive industrial clusters in Suzhou include:

(1) Integrated circuit industry: forming a "one core, two wings" layout with industrial parks and high-tech zones as the core. Leading enterprises have established layouts in design, manufacturing, packaging and testing, materials and equipment, such as Silicon Products Technology, Hejian Chip, and Siripu.

(2) New Display Industry: Bringing together well-known domestic and foreign enterprises such as Samsung Display,

AU Optronics, and Visionor, it has strong capabilities in the fields of OLED, Micro LED, and other new displays.

(3) Software and Information Technology Services Industry: Suzhou's industrial software industry has strong capabilities and relies on a strong manufacturing foundation to form distinctive advantages in areas such as CAD/CAE/CAM, MES (Manufacturing Execution System), and industrial control software.

(4) Artificial Intelligence and Big Data Industry: With Suzhou Industrial Park as the core, it has attracted a large number of AI algorithms, computing power, and data companies to settle in and actively expand their applications in fields such as autonomous driving, smart cities, and financial technology.

(5) The Internet of Vehicles (Intelligent Connected Vehicles) industry: Xiangcheng District, Suzhou has successfully been approved as a national-level leading zone for the Internet of Vehicles, gathering a group of autonomous driving unicorn enterprises such as Momenta and Zhijia Technology, and is building a complete industrial chain from perception, decision-making, to execution.

2.3. Using the closed-loop cycle of demand-driven technology supply as a lever to assist in the formation of coupling bodies

Obviously, Suzhou has strengthened the demand for industrial digitization and technology supply for digital industrialization, forming a close "closed-loop coupling". Through the closed-loop coupling, it effectively promotes the coupling between the two. In the process of digital and intelligent upgrading of traditional industries, there has been a huge demand for industrial Internet, big data, artificial intelligence, industrial software and other technologies and services, which has become a "pilot field" and "application field", strengthening the driving effect of the digital economy. With the core industries of Suzhou's digital economy, such as cloud computing, big data, artificial intelligence, integrated circuits, etc., providing leading technological support for local enterprises and offering more stable, applicable, and optimized solutions. The government plays the role of an adhesive and catalyst in the coupling body. Through top-level design, policy guidance, platform construction, and scenario openness, the supply and demand sides are precisely connected, making the coupling body more stable, smooth, and effective.

Table 1. Integration table of digitalization and digital industrialization of Suzhou industries

Dimension	Industry digitization	Digital industrialization
Strategic Path	Smart transformation to digital connectivity: intelligent transformation, digital transformation, and networked connectivity. Layered promotion: Leading enterprises establish benchmarks, while small and medium-sized enterprises use platforms.	Cluster development: Building digital industry clusters such as artificial intelligence and industrial software. Independent innovation: tackling key technologies such as industrial software and large models.
core business format	Intelligent manufacturing: lighthouse factory, intelligent workshop, 5G factory. Industrial Internet: "5G+Industrial Internet" application. Digitalization of service industry: digital finance, digital trade, smart tourism, etc.	Industrial intelligence industry: big models, computing algorithms, and integrated applications. Industrial software: software for research and development, design, and production control. Technology services: integrated circuit design, industrial design, inspection and testing.
infrastructure	Network: 5G base station, gigabit optical network. Identity resolution: industrial Internet identity resolution secondary node.	Computing power: Suzhou Public Computing Service Platform Data: Public Data Base, Industry Dataset

3. The coordinated development model of the "native digital ecosystem" in Shenzhen

3.1. Significant effect of digital upgrading in traditional industries

Relying on traditional industries, there is a huge demand. Guided by the goal, strengthen the path and implementation

schedule, and continuously form a driving force. For example, Shenzhen plans to promote the digital transformation of all 13000 large-scale industrial enterprises in the city by 2025, emphasizing the integration of cloud, data, intelligence, and empowerment. Following the idea of developing one generation and applying one generation, we will vigorously promote the application of digital intelligence achievements. For example, digital twin technology is used to build a city-wide spatiotemporal information platform (CIM), providing a unified database for urban management. Accurate policy support and tailored government policies to further support development. For example, Shenzhen has established a digital transformation support program for traditional advantageous industries, with a maximum subsidy of 5 million yuan for eligible projects.

3.2. Digital intelligence clustering cultivates a new ecosystem

Firstly, factor ownership ensures the value of factors, serving as a stimulant for the digital industry. Shenzhen is the first in China to legislate for data (Shenzhen Special Economic Zone Data Regulations), which has been successfully applied in areas such as inclusive finance and commercial factoring. Secondly, the digital + intelligent entire industry chain consolidates the foundation of the new ecosystem. Shenzhen's goal is to achieve a scale of over 800 billion yuan in the artificial intelligence terminal industry by 2026, striving for 1 trillion yuan. By distributing "corpus vouchers" (up to 50 million yuan per year) and other means, we aim to incentivize the construction and circulation of high-quality AI datasets and cultivate an AI innovation ecosystem from the source. Once again, we will increase investment in digital infrastructure to optimize the development environment. Release the 'Action Plan for Ultra Fast Broadband Pioneer Cities 2025', promote the coverage of 10 gigabit optical networks and 5G-A networks, and create an intensive and efficient computing power dispatch platform to provide a solid 'pillar' support for the development of the digital industry.

3.3. The integration cycle of ecological co-construction and paradigm reconstruction helps couple the two

In the process of digital economy development in Shenzhen, the deep integration of new clusters and traditional applications continues to deepen the construction and optimization of the digital ecosystem. Firstly, strengthen the application of traditional industries in digital transformation, such as industrial AI quality inspection and intelligent scheduling, to provide a value foundation and practical support for realizing new clusters of digital industries. Secondly, technology-driven development serves as the foundation, continuously promoting upgrading and innovation. The improvement of the data element market and the development of the AI terminal industry have provided more advanced and easily accessible tools and solutions for traditional industries, significantly reducing the threshold and cost of upgrading, transformation, and digital innovation, and continuously enhancing competitiveness. The formation of a new paradigm through new clusters, new applications, and new values has effectively promoted the coupling of the two.

Table 2. Integration of industrial digitization and digital industrialization in Shenzhen

Dimension	Strategic direction	Core initiatives/key areas	Typical Practices / Development Goals
Digitalization of industries	Promote the intelligent and high-end transformation of traditional industries	Intelligent manufacturing: build intelligent factories and promote the industrial Internet. Technological Empowerment: Utilizing technologies such as AI and digital twins to transform production processes. Policy support: Provide special funds and support plans for digital transformation. Goal: By 2025, all industrial enterprises above a designated size in the city will achieve digital transformation.	Practice: Pingshan District will be selected as one of the first 14 advanced-level intelligent factories in 2025; Guangming District is building a digital industrial innovation center.
Digital industrialization	Developing emerging digital industries such as data elements and artificial intelligence	Data Factor Market: Establish a data trading platform to promote the authorized operation of public data. Artificial intelligence terminals: developing AI smartphones, computers, wearable devices, etc. Infrastructure: Build a 10-gigabit optical network, a 5G-A network, and an integrated computing power platform.	Goal: By 2026, the scale of the artificial intelligence terminal industry aims to reach 1 trillion yuan. Practice: Establish Shenzhen Data Exchange; Distribute "corpus vouchers" to cultivate the AI ecosystem; Activate the New Quality Productivity Empowerment Platform 10.

4. Guiyang's "project-based" digital development model

Strengthen the driving effect of "China's data valley". Since the first holding of the Data Expo in 2015, it has become a "barometer" in the global big data field, with a significant driving effect. Continuously attracting top global companies such as Huawei and Tencent to settle down has truly achieved a new path of project-driven urban digitization development.

4.1. The industry digitalization characteristics of "layered promotion and strengthened services" are obvious

In the process of promoting industrial digitization, Guiyang has noticed the differences among enterprises of different scales and adopted a strategy of layered and precise promotion. For small and medium-sized enterprises, the core is to lower the threshold and provide support. The solution of "small, fast, light, and accurate" reduces the difficulty of transformation and provides real subsidies, greatly alleviating the dilemma of small and medium-sized enterprises being "unwilling, afraid, and unable to transform". For leading enterprises, it is to set benchmarks and provide strong leadership. Supporting leading enterprises such as Guizhou Tire and Guiyang Hisense to build world-class smart factories, their successful practices can provide replicable paths and experiences for a large number of small and medium-sized enterprises in the industry, ultimately driving the upgrading of the entire industry chain.

4.2. Empowering digital industrialization with "focusing on projects and radiating industries"

Grasp key projects, rely on talents, grasp the nose of data, and strengthen the "cornerstone" effect of data. Through highly attractive talent and subsidy policies, Guiyang has quickly formed a comparative advantage nationwide, building a full chain closed-loop of industrial digitization from collection to application. Emphasizing the driving effect of digital industrialization projects, emerging industries and projects such as robotics and additive manufacturing (3D printing) are developing rapidly, forming technological support. Attract leading enterprises to settle down and encourage them to serve local industries, continuously promoting the process of digital industrialization.

4.3. Based on the enhanced cycle of data-driven value creation, promote the coupling of the two

The vigorous development of Guiyang's digital economy cannot be separated from its advanced layout and continuously optimized ecosystem of computing power and data elements. A significant feature of its computing power structure is that intelligent computing accounts for up to 98%, which precisely fits the huge demand for intelligent computing power in the current AI big models and the intelligent application explosion. At the same time, Guiyang not only builds computing power facilities in technology, but also dares to explore at the institutional level. By building a big data exchange and innovating a trustworthy data space, it attempts to solve core problems such as property rights confirmation, circulation, security, and pricing in the process of data element marketization, laying the foundation for the realization of the value of the data industry and long-term healthy development.

5. Enlightenment from promoting the coupling of industrial digitization and digital industrialization

5.1. Inspiration from the Suzhou Model

Firstly, based on our own industrial endowment, we should work together to promote the synergy between supply and demand. Only subsidizing the demand side (enterprise transformation) can easily lead to "foreign monks reciting scriptures" and hinder the growth of the local digital industry; Supporting only the supply side (digital enterprises) may result in technology being disconnected from practical applications. We must grasp both sides and promote localized integration of supply and demand. Secondly, there is a close integration between "proactive government" and "efficient market". Once again, on a certain development foundation, we will move towards the advanced form of "integration of data and reality". From the "smart transformation and digital transformation" of individual enterprises to the collaborative

innovation of the entire industry chain and supply chain. Finally, actively explore "rules and standards". Actively participate in the formulation of rules for data security, privacy protection, and digital transformation standards, and strive for a voice in the field of digital economy governance.

5.2. Inspiration from the Shenzhen Model

Firstly, delve into the value of data as a new factor of production. Through a series of measures such as legislation, the establishment of trading venues, and the implementation of public data authorization operations, data can flow safely and compliantly, creating value. For example, through local credit reporting platforms, data fusion applications have supported enterprise financing of over 680 billion yuan, with the vast majority serving small and micro enterprises. Secondly, driving the development of the digital economy with future industries as the guide. Forward-looking layout of future industries such as artificial intelligence, by issuing "corpus vouchers" ["Corpus vouchers" are a financial subsidy tool launched by local governments to support the development of the artificial intelligence industry, mainly used to reduce the cost of enterprises in high-quality data (corpus) procurement or open sharing.] Funding data procurement and opening, building corpus alliances, and other methods are used to cultivate the AI innovation ecosystem from the source. Finally, to promote inclusiveness and friendliness, we will continuously strengthen the digital economy. Shenzhen's digitalization has always emphasized inclusiveness and focused on building a "digital-friendly society". This reflects the "no application, enjoy" policy for online government services, as well as the care for special groups offline, such as promoting aging-friendly and barrier-free digital transformation in cities, allowing digital technology to benefit everyone.

5.3. Inspiration from the Guiyang model

Firstly, one should be adept at leveraging opportunities to build momentum. Be good at building and utilizing high-end platforms to gather resources. Secondly, we should integrate the development of "policy-led enterprises" and "ecological agglomeration". The investment model in Guiyang has undergone an upgrade from introducing individual projects to building an industrial ecosystem. For example, in developing the robotics industry, Gui'an New Area not only introduces complete machine factories, but also synchronously introduces core component supporting enterprises, and finally strives to form a collaborative ecosystem of "computing power data robot". The key to industrial competition lies in building a complete industrial ecosystem that covers technology, capital, talent, and applications, and forming cluster competitiveness.

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