

# Focus on Multi-Dimensional Integration of Wuxi Modern Industrial Cluster Innovation and Development Model

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**Abstract:** Wuxi, located in the center of the Yangtze River Delta, is an important part of the Suzhou-wuxi-changzhou metropolitan area and a typical representative of the southern Jiangsu model of China's regional economy, wuxi, which is in the transition period of economic structure, can rank the top of the per capita GDP of the central cities in China, and has its own unique modern industrial cluster development model. Based on a large number of on-the-spot investigation and research, this paper analyzes the basic advantages, main characteristics, industrial structure transformation and development layout of modern industrial cluster in Wuxi, this paper makes a systematic analysis and induction of the important supporting and ensuring factors that constitute the modern industrial system with Wuxi characteristics and the layout of innovative industrial structure, it is intended to reveal the development process, the reality, the basic characteristics and the advanced experience of the southern Jiangsu model in order to obtain the necessary enlightenment and reference. At the same time, put forward the existing problems and suggestions.

**Keywords:** Multi-Dimensional Integration, Wuxi, Industrial Clusters, Transformation, Innovation Mode

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## 1. Introduction-Why Wuxi Should Be Studied

Located in the center of the Yangtze River Delta, Wuxi is an important part of the Suzhou-Wuxi-Changzhou metropolitan area, the cradle of China's national industry and township industry, and the birthplace of the southern Jiangsu model. In 2022, Wuxi's gross national product reached 1485.1 billion yuan, which is the central city with the highest GDP per capita in the country [1]. It is also a model to witness and lead China's regional economic reform and development and the successful construction of industrial clusters for more than 20 years. Among them, innovation-driven strategy is the continuous engine for the rapid development of Wuxi industrial cluster. From scientifically improving the advantages of traditional industries to fully grasping the market capital and competitive environment, from strengthening the construction of the park to cultivating high-tech

leading enterprises, from guiding industrial transformation and upgrading to constructing end-to-end ecological chain system of the whole industry, from emphasizing the introduction of talents to highly integrating science and technology with industry, A series of measures constitute the important support and guarantee for Wuxi to accelerate the construction of characteristic modern industrial system and the layout of innovative industrial structure. In particular, they bring many inspirations, which is exactly the purpose and significance of our research on the innovative development mode of Wuxi modern industrial cluster.

## 2. Basic Advantages and Main Characteristics of Wuxi Modern Industrial System

First of all, the innovation-driven strategy and the strategy of strengthening the city through industry are the main

strategic support for Wuxi to accelerate the promotion of industrial transformation and upgrading and the continuous expansion of the scale of industrial clusters. Especially with the high quality improvement of key industries in recent years, the city's manufacturing industry has gradually formed a strong development state.

Wuxi is a city with a long manufacturing tradition. Over the years, the construction of industrial clusters has significantly improved the quality of development of enterprises and industrial clusters through further upgrading, transformation, accumulation and development, from the layout of characteristic parks to professional industrial clusters, from the construction of industrial chains to more attention to the ecological extension of upstream and downstream industries; The successive construction of five national high-tech zones and several provincial and municipal high-tech parks in Wuxi has provided a good space for survival and growth as well as important support and guarantee for the healthy development of Wuxi's scientific and technological innovation and high-tech industries, as well as the breeding and development of various traditional, modern and characteristic industrial clusters in the city, and has played a very important role in radiating and driving the economic development of Wuxi [2].

In recent years, Wuxi has adhered to building industrial clusters in key areas to enhance the stability and competitiveness of regional industrial chains and supply chains. By the end of 2022, the number of industrial enterprises above the designated size in the city exceeded 7700, 14 enterprises were listed in the top 500 Chinese enterprises in 2022, 25 enterprises were listed in the top 500 manufacturing enterprises [3], and the number of major industrial clusters in the city has grown to 56, including digital economy, the Internet of Things, integrated circuits, biological medicine, energy conservation and environmental protection, high-end textiles Ten industrial clusters, such as new energy, automobiles and parts, high-end equipment, and special steel, have become more than 100 billion clusters. Wuxi IoT industrial cluster has entered the ranks of the first batch of advanced manufacturing clusters in the country [4].

Secondly, it attaches importance to the introduction of talents, the development and support of science and technology, and the high integration of science and technology and industry is also a significant feature of the development of Wuxi industrial cluster.

The multiple growth of invention patents is a full reflection of the emergence of Wuxi's scientific and technological talents and the development of high-tech innovation. A series of talent introduction and incentive mechanisms and a complete scientific and technological investment and financing system have laid a solid foundation for integrating the city's talents and various scientific and technological innovation resources, stimulating innovation vitality, and creating a good ecological chain of innovation, entrepreneurship and creation.

Wuxi has maintained a high contribution rate of scientific and technological progress for many years. In 2021, the number of authorized patents in the city reached 79738. In the 23rd China Patent Awards, 15 patented products (technology) projects in

Wuxi were shortlisted, with a cumulative profit of 18.729 billion yuan [5]. At the end of November 2022, the number of invention patents owned by the city reached 44143, and the number of invention patents owned by 10000 people reached 59.14 [3]. With the obvious improvement of the overall profitability of patented products of Wuxi enterprises in recent years, the comprehensive application of intellectual property rights has effectively stimulated and protected technological innovation, greatly promoted the rapid development of industrial economy, and provided strong support for the main line of "structure adjustment and mode transformation" in the city.

Wuxi has a total of 305 provincial-level high-tech enterprises, accounting for 24% of the added value of enterprises above the designated size, and 5546 high-tech enterprises [5, 21]. In 2022, the added value of high-tech manufacturing and equipment manufacturing industries above the designated size in the city will increase by 7.5% and 10.6% respectively over the previous year, respectively, 2.1 and 5.2 percentage points higher than the added value of all industries above the designated size; Among the high-tech manufacturing industries, the manufacturing of aviation, spacecraft and equipment increased by 22.1%, the manufacturing of medical instruments and equipment increased by 13.0%, the manufacturing of electronic and communication equipment increased by 12.5%, and the output value of the city's high-tech industry reached 1197.765 billion yuan, accounting for 50.44% of the total industrial output value on the scale [3]. The high-tech industry has become an important guarantee for Wuxi's economic strength and stable growth.

Third, in order to fully enhance the competitiveness of the city's industrial chain, accelerate the construction of a modern industrial system, and promote the high-quality development of the manufacturing industry, Wuxi has issued a series of industry-oriented policies and safeguard measures. From strengthening the construction of the park to paying attention to the cultivation of high-tech leading enterprises, from guiding the industrial adjustment, transformation, upgrading and integration to emphasizing the construction of end-to-end whole-industry ecological chain system, from emphasizing the introduction of talents, the development of science and technology and platform support, to the high integration of science and technology and industry, to help the development of specialized new small giant enterprises [4]. A series of measures are important support and guarantee for Wuxi's modern industrial system and industrial structure layout.

With the rapid growth of all major industrial chains in the city, the construction pace of transforming from traditional enterprises to emerging strategic industries, from textiles, shoes and clothing to automobile, computer, mobile phone and other industries has been highlighted. At the same time, the number of listed companies in Wuxi A-share has increased to 108 in 2022, including 64 on the main board. The number and total market value of listed companies are among the top ten in the country. With the listing of enterprises, they are becoming bigger and stronger with the help of capital. A new generation of high-quality high-tech enterprises in Wuxi

emerged and competed to compete in the capital market [6]. High-grade textile processing, precision machinery and automobile supporting industry, electronic information industry, characteristic metallurgy and metal products industry, fine chemical industry and bio-pharmaceutical industry have become important pillars of Wuxi industry [2].

With the transformation and development of Wuxi's private industry, in 2022, Wuxi's private industry above the designated size achieved an added value of 302.03 billion yuan, accounting for 54.1% of the city's industrial added value. The added value of private industry increased by 8.7% year-on-year, 3.3 percentage points higher than the average growth rate of the industry above the designated size, and pulled 4.6 percentage points of the city's industrial added value. Wuxi's private industry has continued to become an important supporting force to drive the city's industrial economic growth [3].

### 3. Wuxi's Industrial Structure Transformation and Development Layout Based on Market Competition

The "Fourteenth Five-Year Plan" of Wuxi has established the strategy of building the "465" modern industrial system and industrial science and technology innovation system, and proposed to build and implement "four landmark industries, six advantageous industries, and five future industries". This is also the main strategic measure of Wuxi to analyze the city's enterprise development model, focus on the transformation and upgrading of small and medium-sized enterprises, improve the competitiveness of Wuxi's industry, and develop service industries, enterprises and industrial clusters [7].

- (1) The landmark industry goal of "strong core competitiveness, good quality and efficiency of development, complete industrial chain, high level of autonomy and control, and international influence" is to strengthen the four landmark industry clusters with core competitiveness and international influence, including the Internet of Things, integrated circuits, biomedicine, software and information technology services [7]. Among them, the Internet of Things industry in Wuxi is currently the largest and most influential industrial cluster with a growth rate of more than 20% since 2021. The next step is to continue to cultivate industry leaders and build a national sensor network innovation demonstration zone at a higher level, make breakthroughs in the innovation of "artificial intelligence+Internet of Things", and deepen the large-scale application in industries, transportation, dual-carbon, public security, medical care and other fields. Accelerate the cultivation of world-class Internet of Things industrial clusters, strive to reach more than 500 billion yuan by 2025, and lay the foundation for cultivating a trillion-yuan level new generation of information technology industry integration development highland with international influence [8,

9].

Secondly, Wuxi is also one of the birthplaces of China's integrated circuit industry. The comprehensive strength of the integrated circuit industry cluster in the past 20 years has closely followed that of Shanghai [8]. In order to make the whole "industrial chain" and reach the threshold of high-end industry, Wuxi has introduced a large number of major projects in recent years, such as the production of Huahong and the expansion of Hercules. A large number of integrated circuit talents, technology and capital have gathered in Wuxi. The industrial cluster covers the entire industrial chain of design, manufacturing, testing, equipment, materials, etc. By the end of 2021, the city has more than 400 integrated circuit enterprises of all kinds, including 173 enterprises above the designated size. There are 11 listed integrated circuit enterprises, with annual operating revenue of 178.3 billion yuan, with a growth rate of 25.5% [8].

In addition, wafer manufacturing and packaging and testing have always been the advantages of Wuxi's integrated circuits. The scale and technical level of the integrated circuit packaging and testing industry are leading in the country, among which Xinchao Group ranks the third in the world. Huajin Semiconductor, Changdian Technology and Xingke Jinteng all have a number of advanced packaging patent technologies. In 2020, Wuxi was approved to build the National Integrated Circuit Characteristic Process and Packaging Test Innovation Center. In recent years, according to the highly competitive situation of the international integrated circuit industry, it has further promoted the construction of the whole industrial chain of extension boards and complementary boards, and the design side has developed rapidly. At present, nearly 200 design enterprises have formed a relatively complete supporting category in the supporting supporting field, and have achieved a leading position in multiple sub-sectors. Wuxi's integrated circuit industry is expected to usher in explosive development [4].

- (2) We should focus on high-end equipment, high-end textile and clothing, energy conservation and environmental protection, characteristic new materials, new energy, automobiles and parts (including new energy vehicles) with high market share and national competitiveness.

The existing advantageous industries in Wuxi are strengthening their characteristics, enhancing their momentum, and constantly climbing up the value chain. Many of them are transformed from traditional industries and transformed into new enterprises through intelligent and green transformation. The industries and products are either upgraded or integrated with emerging industries. For example, Wuxi, as a traditional textile industry city, the total number of textile enterprises has been greatly reduced, but the added value of products has been increasing. New fiber, advanced textile and brand clothing have become the direction of its transformation; Another example is the traditional chemical industry. With the transformation of urban economic development, a large number of enterprises have been shut down. In fact, some enterprises have successfully transformed

into the direction of characteristic new materials and become a member of the new industrial cluster; For another example, the "two machines" industry in Wuxi, as the high-end equipment in the advantageous industries, is also developed from the successful transformation of the traditional machinery manufacturing industry [10, 11].

In general, Wuxi's advantageous industrial clusters have certain competitive advantages in China. Over the past few years, Wuxi's advantageous industrial entities have successfully completed the transformation, upgrading, integration and rapid development from traditional industries to modern industries with domestic influence.

- (3) The artificial intelligence, quantum technology, third-generation semiconductors, hydrogen energy and energy storage, and deep-sea equipment industries proposed by Wuxi are all the future industries of the world, with great development potential and a wide range of influence across fields. Once the scale is formed, it will have a strategic impact on Wuxi's economic structure. In fact, many industrial projects have developed to some extent in Wuxi, and even have influence. For example, the deep-sea equipment industry represented by Jiaolong, the integration of artificial intelligence and the Internet of Things, the development of hydrogen energy and energy storage, the third generation semiconductor represented by GaN and SiC, and China Resources Microelectronics have also been laid out, and in terms of quantum measurement, there is also a park in Huishan District, Wuxi, and so on [4].

According to the development layout of Wuxi's industrial chain, it is necessary to focus on elaborately creating landmark industries, consolidating and expanding advantageous industries, cultivating and developing future industries, fully cultivate the "3010" industrial chain system, form 30 advantageous industrial chains with high accumulation, embeddedness, progressiveness, strong collaborative innovation and brand influence, and 10 excellent industrial chains with comprehensive competitiveness and innovation ability reaching the international and domestic advanced level [1]. In order to ensure the core competitiveness, international influence, market share, and the viability and development potential of Wuxi industrial cluster across fields and borders.

#### **4. Multi-Dimensional Integration of Wuxi Industrial Cluster Innovation Development Model**

The rapid development of Wuxi's modern industrial system construction is the comprehensive result of its scientific promotion of traditional industrial advantages, full use and grasp of market capital and competitive environment, successful promotion of industrial transformation and upgrading, and multi-dimensional construction of innovative industrial chain. From the perspective of the construction basis, market positioning, construction ideas, scientific basis,

influencing factors and future development of modern industrial clusters, the construction of Wuxi's modern industrial system structure fully reflects the high integration of market competition strategy and scientific and technological innovation strategy, and the construction mode of each unit element shows its functions and complements each other, integrating inheritance, innovation, interconnection and open thinking, which brings enlightenment in many aspects.

- (1) Under the premise of scientific positioning, Wuxi can pay close attention to the implementation, and the guarantee mechanism is fully in place. In particular, it has adhered to the "double chain" leadership linkage responsibility system for the development of industrial clusters and flexibly applied the "one industry, one policy" and other special service policies, providing strong support for the survival, growth and development of local industrial clusters [12].
- (2) The construction of Wuxi's highly developed high-tech zone has laid a good foundation for it to give full play to the main role of high-tech industrial cluster development in industrial parks, industrial parks, incubation parks, innovation parks, demonstration parks and other parks at all levels, and to further optimize the spatial structure layout, accelerate the transformation of industrial parks from production park economy to comprehensive urban economy, and promote the integration of industry and industry, industry and education, and industry and city [13].
- (3) Wuxi attaches great importance to the construction of the ecological chain of industrial clusters, strengthens its core competitiveness and completes the main line of the industrial chain, issues a regional "whole industrial chain" construction plan, and vigorously promotes the digital transformation of the whole process of production and manufacturing, the whole industrial chain, and the whole life cycle of products, as well as the construction of intelligent manufacturing projects in the whole region, with obvious results, and gradually forms a covering the production of raw materials from upstream, The whole industrial chain system of midstream production link and downstream terminal product production has great potential for development [14].
- (4) Wuxi attaches great importance to the transformation and upgrading of small and medium-sized enterprises, especially for traditional industries, which are upgraded, integrated and adjusted according to the needs of market, science and technology and ecological development, and focuses on promoting the digital transformation of production and manufacturing. The level of intelligent manufacturing in the whole region has been rapidly improved. After the transformation and upgrading of Wuxi's traditional textile industry, it has become a high-end textile industry cluster, still glowing with great industrial vitality. In 2021, Wuxi's high-end textile industry cluster has 973 industries, with an output value of nearly 110 billion yuan [15]; Schneider Wuxi Factory

is characterized by the assembly and production of small batches and multiple varieties of products, and has long been in the leading position in lean manufacturing and digital transformation. The level of intelligent manufacturing in the whole region has been rapidly improved, highlighting the outstanding achievements in improving efficiency and promoting end-to-end emission reduction through digitalization, and setting a model for the upgrading of manufacturing industry to green intelligent manufacturing [16].

- (5) Create landmarks and build brands, always adhere to the concept that "chain owners" and leading enterprises are the main engines of industrial clusters to build chain extension and strengthen chain supplement, increase the cultivation and introduction of leading enterprises, boldly select industries with strong industrial and regional basis and characteristics to lead the demonstration, and vigorously build and establish landmark industries with strong core competitiveness, complete industrial chain, high level of autonomy and control and international influence, The results are also obvious to all. In 2022, Wuxi completed a total industrial output value of 2.4 trillion yuan, an increase of 8.8% year on year, and industrial investment achieved a positive growth. Among them, the machinery industry has become the first trillion industry in Wuxi [17, 1].
- (6) Wuxi insists on taking investment attraction as the key to drive the economic development of the city, and on optimizing the way of investment attraction and promoting the implementation of projects, guiding, supporting and relying on and empowering relevant industries, industrial clusters and leading enterprises to build regional headquarters economic demonstration parks, or introducing or uniting large enterprises and financial investment institutions to try to build regional headquarters base and high-end factor clusters, Schneider, Deutschland The introduction of a large number of strategic emerging industries and pillar industries, such as Fuji, Meihua, Bluestar, Zhengmao, AstraZeneca, Caterpillar, Bosch, Cummins, and Lucent, has played an important role in the construction of a strong Wuxi industrial cluster [18].
- (7) Wuxi attaches great importance to the scientific and technological support of industrial development and the high integration of industry, industry and education, and attaches importance to strengthening the construction of engineering technology research centers at all levels, national laboratories and scientific and technological platforms and national international cooperation bases. In the 2021, R & D expenditures of Wuxi's regulated industrial enterprises reached 44.502 billion yuan [19], and the contribution rate of scientific and technological progress of the whole city exceeded 68% in 2022 [20]. The successive construction of a series of "Wuxi Research Institute of XX University" has made outstanding contributions to Wuxi's full use of the

high-tech resources of national first-class scientific research institutions and promote the high-end, green, intelligent and multidimensional development of regional industries and industries [18].

- (8) Giving full play to the talent advantage is also one of the most significant characteristics of the development of Wuxi industrial cluster. The implementation of policies such as "Oriental Silicon Valley", "the Taihu Lake Lake Talent Plan", 12 "tin talent introduction", "tin talent introduction" project for outstanding college students, and 10 "enterprise talent assistance" has injected strong impetus into the construction of Wuxi's scientific and technological talent team. By the end of 2021, Wuxi's professional and technical personnel have increased to 1.1293 million, accounting for 26% of the city's employees, including 115835 industrial R&D personnel above the designated size [19]; Wuxi has successively introduced more than 1.954 million talents in the past 10 years, including 17 Nobel laureates and nearly 100 Chinese and foreign academicians [5]; A large team of professional and technical personnel and various kinds of cutting-edge talents are the powerful driving force and guarantee for Wuxi's technological innovation and high-tech industry development.

## 5. Conclusion

Since the beginning of the 21st century, the economic vitality of the Yangtze River Delta, Pearl River Delta, Zhejiang and Fujian coastal regions has been evident in the mainland of China after nearly 30 years of reform and opening up. Several typical empirical models of regional economic development in China have been formed, namely, the Southern Jiangsu model, the Jinjiang model, the Pearl River model and the Wenzhou model. To a certain extent, it also reflects the typical characteristics of South Jiangsu model, such as high-speed growth, government intervention and orientation, extensive extension (high input, high consumption, etc.), tilted economic structure (slow agricultural development, etc.) and the transition to intensive growth. There is no doubt that the multi-dimensional integrated modern industrial cluster innovation and development mode displayed by Wuxi will bring many inspirations and references to the development of similar large cities in China and abroad.

In fact, Wuxi's economic development has been in a slow period in recent years. The reason is that it is in a period of transition. The original industrial production mode of "three high and one low" needs to be transformed, and this process has paid a certain price. In recent three years, the population increment of Wuxi is less than 30,000, and the natural growth rate of population decreases, which makes Wuxi face unprecedented pressure [22]. Wuxi has entered the aging stage since 1980. Both the aging population and the shortage of working population will be further aggravated. In order to build a manufacturing highland in Wuxi, a large number of young labor force with basic education is needed to introduce young

population, which can also alleviate the problem of aging population in Wuxi. Looking at Suzhou's talent introduction model, it not only has the same policies as Wuxi, such as housing subsidies, but also provides measures for young backpackers to "move in". One is a business environment, the other is an ecological environment, and the other is a livable living environment. In these three environmental aspects, if we do a good job, talent will have its use.

In addition, Nantong has not invested as much in strategic emerging industries as Wuxi, while peripheral cities have invested much more in Nantong. In this sense, the promotion of external cooperation is also a very important issue Wuxi should face.

Wuxi's integration is based on the needs of the development of the industry, but in the layout of some advanced factors of production can be a network, "to the city with the county" thinking is desirable? Should Jiangyin, Yixing and other counties and cities in Wuxi have more extensive external contacts, avoid excessive dependence on Wuxi city center, and form an interactive, networked and fairly equal joint development idea should be more reasonable. At present, Wuxi's IC industry is mainly characterized by sealing and testing and manufacturing, which is its advantage, but also its short board. Because in the semiconductor industry chain, from design to manufacturing to sealed test and a series of processes, packaging and testing is a very important production link, but it is also a relatively low technical content of a link, the highest technical content is the design link. In this way, we should carry out joint scientific and technological breakthroughs, connect Shanghai, Suzhou and Wuxi, which have strong industrial development capabilities in research, design and production, and conquer some key technologies through joint breakthroughs.

Another shortcoming of Wuxi's development mode is that it mainly relies on processing of incoming materials and has a relatively short industrial chain, so it relies on foreign investment to a high degree. In addition, local governments have fierce competition in attracting foreign investment, and some profits may be lost [23].

But Wuxi's so-called "Sunday engineer" model is to attract skilled workers from Shanghai to work in the city over the weekend, borrowing human resources from outside the city to boost the local economy. This model has strong vitality in many other parts of the country today, including abroad.

Ecology and innovation are the two key wheels. Wuxi also has Taihu Lake and is located in the Shanghai metropolitan area, which is a new development opportunity for Wuxi. Wuxi is in the position to build a professional global city. In order to truly play a better international influence in the professional field, Wuxi, as a Class I big city in China, needs to further improve the level of opening to the outside world, promote the upgrading of the industrial structure of the whole city with a more open mind, and improve its competitiveness.

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