

Thoughts on the Innovation and Development of Manufacturing Industry in Anhui Province

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Abstract

In order to deepen the implementation of the "Made in China 2025" program of action issued by the State Council to promote the development of manufacturing industry in Anhui Province and achieve the goal of manufacturing strong provinces, the People's Government of Anhui Province promulgated "a number of policies to support the construction of a strong province", Industry development focus areas, and related supporting measures and support conditions detailed arrangements. Combined with the characteristics of industrial development in Anhui Province, analysis of the status of industrial development and existing problems for the development of industrial development path and manufacturing innovation center to provide policy recommendations to better promote the development of manufacturing innovation in Anhui Province.

Keywords:Anhui Province, Development of Manufacturing Industry, Innovation Center

Foreword

With the rise of knowledge-based economy and the appearance of information society, the global industry competition pattern is undergoing major adjustment. Manufacturing industry is the foundation of the national economy, the industrial carrier of the powerful country and rich people, and the symbol of national comprehensive strength. The deep integration of the new generation of information technology and manufacturing is triggering far-reaching industrial changes, forming new mode of production, industrial forms, business model, and economic growth point. In order to respond to the new round of scientific and technological revolution and industrial change in the world, and to seize the historical opportunity of reshaping the pattern of international industrial division of labor, to realize the transition from a manufacturing power to a manufacturing power, China has timely proposed the "Made in China 2025" development strategy, aiming at changing the mode of manufacturing development and improving the ability of independent innovation. As a major manufacturing province, the development of manufacturing industry is crucial to Anhui's economic growth. How to change the status quo of the big but not strong manufacturing and achieve the goal of building a strong manufacturing province has become a problem that needs to be considered urgently.

1. Status of Manufacturing Industry Development in Anhui Province

As a member of the Yangtze River Delta, Anhui province has excellent geographical position, strong scientific and technological education, well-developed transportation and communication, and has a good foundation for industrial development. In particular, since the reform and opening up, especially in recent years, the manufacturing industry in Anhui Province has continued to develop rapidly, and a complete range of independent, complete industrial systems have been established, which has significantly enhanced the comprehensive competitiveness of the province. Anhui's traditional pillar manufacturing industry is coal, steel, building materials, textile and other industries. Huaibei mining, Huainan mining, Maanshan iron and steel, Tongling nonferrous metals, Wuhu conch cement, Anqing petrochemicals and textile were all important support for Anhui's industrial development. However, due to the impact of the macroeconomic environment and the limitations of the industry itself, these former "big players" have been strongly impacted, and most of them are now facing the crisis of overcapacity and the pressure of sales and profit decline.

On the contrary, the strategic emerging industries and high-tech industries in Anhui Province have become increasingly strong. With the approval and construction of Hefei-Wuhu-Bengbu National Independent Innovation Demonstration Zone, Hefei Comprehensive National Science Center, Hefei "Made in China 2025" Pilot Demonstration City, etc., Anhui Province's industrial development and manufacturing transformation and upgrading will receive more support of national fund, policy, talent, etc. New industry such as energy-saving and new energy vehicle, smart home appliance, high-end equipment manufacturing, new-generation electronic

information manufacturing, and new material have shown a good momentum of development and are expected to become pillar industry in Anhui Province in the future.

2. Problems in the Development of Manufacturing in Anhui Province

Anhui Province is a large manufacturing province, but it is not a strong manufacturing province. There are still several prominent problems in the development of the industry:

First of all, the traditional advantage manufacturing industry of Anhui province is facing the pressure of transformation and upgrading. The traditional manufacturing industry, such as coal, steel, building materials, textile and clothing and food processing, have all contributed greatly to the growth of Anhui's industrial economy and have played a supporting role in industrial development. However, with the adjustment of the national economic structure, traditional industry is facing a dilemma of growth or even decline. The former advantage manufacturing industry is under tremendous pressure. Take the coal industry as an example, in 2013 and 2014, the losses of the coal industry in Anhui province reached 3.6 billion yuan and 7.1 billion yuan respectively. In particular, in 2015, the coal market price of Anhui province quickly returned to the downtrend after undergoing a short-term correction, resulting in more serious corporate losses, and the annual coal industry loss reached 9.44 billion yuan. The current overall loss of the coal industry is difficult to reverse in the short term. Therefore, in the tide of overcapacity, the traditional manufacturing industry has no alternative but to transition to a higher level. It is necessary to bridge the difficulties of traditional industry and adjust the layout of manufacturing industry in depth. Secondly, although the strategic emerging industry in Anhui province is still in the ascendant, they are still lacking in scale, and the gap is relatively large compared with the developed provinces in China. In recent years, in order to ease the pressure brought about by the transformation and upgrading of traditional industries to industrial development, and in order to respond positively to the national call and enhance the competitiveness of its own industry, Anhui province has strongly supported and promoted the development of strategic emerging industry and high-tech industry. Relying on the support of government policy, the support of local scientific research force and the integration of talent and fund, a number of high-tech industries, such as high-end equipment manufacturing, new generation of electronic information manufacturing, new energy and new material, have flourished in Anhui province. However, these new industries account for a small proportion of the entire manufacturing industry, and they are still insufficient to replace the traditional growth power on the scale and take the responsibility of pulling the growth of the manufacturing industry in the whole province, and there is still a big gap compared with the developed coastal areas.

Finally, there is also an imbalance in the layout of regional manufacturing industry in Anhui province. At the prefecture-level city level, there is a large gap between the industrial development of the cities in Anhui province. As the capital city of Anhui province, Hefei has gathered a large number of resources and attracted many enterprises to settle in Hefei. New industries such as smart home appliance, new energy vehicle, and high-end equipment manufacturing are rapidly developing. Again, such as Wuhu, Ma'anshan, Bengbu, Anqing, etc. all have more or less well-developed industries or enterprises in the province and even the whole country, but other local cities such as Fuyang, Chizhou, Suzhou, etc. itself industry foundation is weak, and lack of related resources, industry development is difficult. This has caused serious imbalance at the prefectural level, which is not conducive to the improvement of overall industry strength in Anhui province.

By sorting out the government industrial policy documents such as the 2016 national economic and social development statistical bulletin of the 16 cities of Anhui province and the government work report, the leading industries in the 16 cities of Anhui Province were drawn; At the same time, according to the publicly released 2016 Top 100 Manufacturers of Anhui province (the actual data are only 81 samples), and classified according to region, industry, etc., the overall arrangement led to the analysis of dominant industries and leading companies in the 16 cities of Anhui province. Some cities in the province are ranked lower in the same industry or have no enterprises entered the top 100 enterprises in the whole province, so there is data blank. The following table shows:

Table 1. Leading industries and leading enterprises in cities of Anhui Province

Cities	Competitive industries	Leading enterprise	Provincial ranking
Hefei	energy saving and new energy vehicle	Anhui Jianghuai Automobile Group Holding Co., Ltd.	1
	new generation of electronic information	Lianbao (Hefei) Electronic Technology Co., Ltd.	1
		Hefei Xinsheng Photoelectric Technology Co., Ltd.	2
	intelligent household appliance	Midea Group Hefei Company	1
		Gree Electric (Hefei) Co., Ltd.	2
	energy saving and environmental protection	Hefei Jingao Solar Energy Technology Co., Ltd.	1
Sunshine Power Co., Ltd.		2	
Anqing	textile	Shenzhou knitting (Anhui) Co., Ltd.	1
		Anhui Huamao Group Co., Ltd.	2
		Anhui Hongrun (Group) Co., Ltd.	3
	chemical industry	China Petrochemical Corporation Anqing Branch	1
	biological medicine	Hainan Wei Kang Pharmaceutical (Qianshan) Co., Ltd.	1
	construction machinery	Anhui Huanxin Group Co., Ltd.	2
Wuhu	energy saving and new energy vehicle	Chery Automobile Co., Ltd.	2
	building material	Anhui Conch Group Co., Ltd.	1
	intelligent equipment	Eft intelligent Equipment Co., Ltd.	1 (Non-manufacturing 81)
Ma'anshan	new material	Sinosteel Anhui Tianyuan Technology Co., Ltd.	1 (Non-manufacturing 81)
		Ma'anshan Xinyang Permanent Magnet Co., Ltd.	2 (Non-manufacturing 81)
	metallurgy	Ma'anshan steel (Group) Holding Co., Ltd.	2
	chemical industry	Anhui Eagle paper Co., Ltd.	2
Bengbu	building material	Bengbu Glass Industry Design Research Institute	2
	food processing	COFCO Biochemistry (Anhui) Co., Ltd.	2
Tongling	metallurgy	Tongling Nonferrous Metals Group Holdings Co., Ltd.	1
	new material	Tongling Jingda Copper (Group) Co., Ltd.	1
Xuancheng	construction machinery	Anhui Zhongding Holdings (Group) Co., Ltd.	1

Chuzhou	Intelligent equipment	Anhui Lande Group Co., Ltd.	1
		Anhui Tiankang (Group) Co., Ltd.	2
Bozhou	food processing	Anhui Gujing Group Co., Ltd.	1
Lu'an	---	---	---
Fuyang	---	---	---
Huainan	---	---	---
Huaibei	---	---	---
Chizhou	---	---	---
Suzhou	---	---	---
Huangshan	---	---	---

3. Policy Suggestions on the Development of Manufacturing Industry in Anhui Province

3.1 Vigorously promote the transformation and upgrading of traditional industry

3.1.1 Strengthen technology research and development from the low-end of the industry to the high-end of the industry. In the global environment with weak growth and declining demand, if the traditional industries are still hovering at the low end of the industry and do not seek change, they will have no future at all. How to break through the resistance in the tide of overcapacity? From the low-end of the industry to the high-end industry development is the right choice. The high end of the industry often occupies most of the profits of the entire industry, and the added value of the high-end of the industry is also much larger than the low-end of the industry. However, to the high-end development of the industry can not be separated from the technical support, strengthen technology research and development in order to occupy the high end of the industry. Anhui province promotes the traditional manufacturing industry from the low end of the industry to the high end of the industry. On the one hand, it is necessary to eliminate the drop and excess capacity in time, reduce the emission of pollutants, and adhere to the work of "going to capacity". On the other hand, enterprises strengthen cooperation with universities and scientific research institutes, increase technological research and development, promote product structure adjustment, vigorously develop new products with high added value and high technological content, comprehensively enhance product competitiveness and enterprise strength, and realize industrial transformation and upgrading.

3.1.2 Integrate industrial value chains and promote the integration of traditional industries with upstream and downstream industries. Each industry will have its own upstream and downstream industries. The traditional manufacturing industry, such as coal, steel, building materials, and other industries in Anhui province, has faced the plight of overcapacity and weak growth. An important path for the transformation and upgrading is to integrate with the upstream and downstream industries. Traditional manufacturing enterprises such as coal, iron and steel, building materials, and textiles in Anhui province should strive to take a diversified, high-end, green, and service-oriented path and through mergers and acquisitions, equity participation, strategic cooperation, and asset pooling to promote the integration and development of their own enterprises with upstream and downstream industries, and new technologies and new formats. Taking the coal industry as an example, the coal enterprises in Anhui province should speed up the transformation of the management concept and strive to change from the traditional coal mining industry to the modern industrial system, and promote the coordinated development pattern of coal mining, electric power, coal chemical industry, building materials, new energy, modern logistics, electronic commerce, financial services and other diversified industries. By taking a diversified, green, and high-end development path, achieve deep processing and conversion of coal and upgrade the entire industrial chain, greatly increase the value-added of the industrial value chain and products, and effectively improve the overall development quality and efficiency of the coal industry. The traditional industry in Anhui province only takes the road of integration and development with the upstream and downstream industries, and the establishment of a diversified industrial system is expected to be successful.

3.2 Speeding up the cultivation and development of strategic emerging industry

3.2.1 Continue to expand the scale of the industry. Although the strategic emerging industries in Anhui province have maintained a relatively rapid growth rate, they are still lacking in the industrial scale. The next step in Anhui is to strengthen the investment in strategic emerging industries, speed up the construction of a batch of strategic new industrial agglomeration development bases, push forward a batch of major new industrial projects, actively cultivate a batch of major new industry special, and build an innovative modern industrial system. In the new generation of electronic information, high-end equipment manufacturing, energy-saving and new energy vehicle, intelligent household appliance, new material, bio-pharmaceutical and other areas continue to increase investment in human, financial, and other resources, and strive to maintain a strong momentum of development and continue to increase the scale of output value.

3.2.2 Combining its own advantages, it will enlarge and strengthen some emerging industries. Compared with the domestic economically developed provinces, it is unlikely that Anhui province will achieve full-scale catch-up in strategic emerging industry. Under this circumstance, Anhui province can choose to combine the actual situation of the province, focus on supporting and developing some strategic emerging industries with comparative advantages, improve the industrial competitiveness of the province, and narrow the gap with other provinces. Hefei's smart home appliance, new energy vehicle, new generation of electronic information, energy conservation and environmental protection, new energy vehicle in Wuhu, intelligent robot, new material in Ma'anshan, and new type of glass in Bengbu all have certain comparative advantage in the country, integrating related resource, and focusing on cultivating and developing these advantage emerging industries can promote the development of industrial economy in Anhui province.

4. Construction of Anhui Manufacturing Innovation Center

As the first of the “Five Projects” of “Made in China 2025”, the construction of the national manufacturing innovation center is an important measure for implementing the strategy of building a strong nation and constructing a national manufacturing innovation system. According to the requirement of the Ministry of Industry and Information Technology's “Guiding Opinion on Improving the Manufacturing Innovation System and Promoting the Construction of Manufacturing Innovation Center”, it will focus on the transformation and upgrading of key industries and the major common needs of innovation and development in the new generation of information technology, intelligent manufacturing, additive manufacturing, new material, bio-medicine and other fields, building a batch of manufacturing innovation centers. By 2020, about 15 national manufacturing innovation centers will be formed; by 2025, 40 or so national manufacturing innovation centers will be formed. A number of provincial and regional manufacturing innovation centers will be built up in the areas with strong condition and comprehensive strength as the support and supplement for the national manufacturing innovation center. At present, a total of two national manufacturing innovation centers have been approved, namely Beijing National Power Battery Innovation Center and Xi'an National Additive Manufacturing Innovation Center. The provinces (municipalities) are also actively applying for and planning the construction of manufacturing innovation center, and have respectively issued a number of policies and measures to support the construction of manufacturing innovation center. In order to actively respond to the national call, promote the development of manufacturing industry in Anhui province, achieve the goal of moving from a large manufacturing province to a strong manufacturing province, the people's government of Anhui province has issued “several policies to support the building of a strong manufacturing province”, proposed the development concept of innovation, coordination, green, openness, and sharing as the guide, and in accordance with the principles of overall planning, phase implementation, emphasis on key points, and policy coordination, gradually promoted the construction of manufacturing innovation center, striving to create a relatively complete manufacturing innovation system that will support our province's construction of strong manufacturing province by 2025. The specific goal is to focus on building 30 provincial manufacturing innovation centers by 2020, and to form about 50 provincial manufacturing innovation centers by 2025.

So how should the manufacturing innovation center be built? Combination of domestic and foreign cases can get some inspiration:

Table 2. Comparison of Manufacturing Innovation Centers in U.S., UK, Germany and China

Center Name	Financing Mode	Operation Mode	Sustainable Development Mode
U.S. Digital Manufacturing and Design Innovation Institute Center	The government and the enterprise jointly financed construction. The US Department of Defense, the Illinois Government, the Chicago municipal Government, the University of Illinois, and member enterprises.	A commercial operation mode is adopted, daily management is assigned to a non-profit organization, a board of directors is set up, and it is responsible for making decisions on major issues of the center. Members of the board of directors come from various member organizations, and all parties concerned will have a certain seat. An independent director and an executive director are set up by the board of directors.	Sustainable income model: membership fees, service fees, financing of technology transformation projects, use fees of intellectual property, contract research, product trials, donations, etc. Targeting the establishment of personnel training mechanism: Identify the talents required for the application of new technology, feedback to the education system, and joint universities, community schools, and technical schools to deliver qualified and matched researchers and skilled workers for emerging manufacturing industry.
British High Value Manufacturing Center	One-third came from government agencies represented by the TSB, one-third from cooperative projects funded by the public and private sectors, and one-third from research and development contracts funded by enterprises.	Government + enterprise model. The British Technology Strategy Committee and its Advisory Committee are responsible for the supervision and management of the center. Each center has a corporate-led management committee responsible for the operation of the center.	The Center promotes the combination of technology and capital, technology and business, research, integration, development and commercialization of technology. To attract cross-border cooperation between enterprises of different sizes (including transnational corporations and small enterprises), and to cooperate with outstanding universities and related institutions in the United Kingdom to form a new framework of technological innovation in the UK.
German Manufacturing Innovation Network	The federal government and the state government jointly funded the formation and development of an innovation network. Corporate membership fees are the main source of operating fund.	Public-private partnership model. The federal government is responsible for strategy and planning. The state government fosters "weaving nets" and "weaving nets" are mostly non-profit science and technology intermediary organizations. They adopt a committee-based operation method and are responsible for the specific management of innovation networks.	Mature foundation inspired by innovation clusters. The promotion of supporting policies and supporting funds. Play the key role of "weaving nets", that is, non-profit scientific and technological intermediary organizations. Mature and perfect technology innovation service system, government guidance, mobilize the entire social forces.
China National Additive Manufacturing Innovation Center	Government + enterprises + universities + research institutes. The national manufacturing innovation capacity construction project 200 million yuan fund and provincial 2016 matching funds have been allocated in place.	Corporate legal system, independent decision-making business activities. The members of the decision-making body of the Innovation Center are widely represented, including representatives from member units, outstanding individuals from the industrial and scientific communities. Implementation of the project manager system, large contractors.	Governments, enterprises, universities, and research institutes collaborate and work together to establish and provide support. The legal model of corporate legal system, self-determination of business activities, self-financing and self-development. Core competitiveness of innovation center technology research and development.

4.1 Financing Mode

Many manufacturing innovation centers at home and abroad mostly adopt public-private partnership in financing, which is jointly funded by the government and enterprises. Taking the US Digital Manufacturing and Design Innovation Institute Center (DMDII), the UK High Value Manufacturing Center (HVM) and China's National Power Battery Innovation Center, and the National Additive Manufacturing Innovation Center as examples, the government and the enterprises' joint investment are used as an exception financing. When

constructing a manufacturing innovation center in Anhui province, this model can also be adopted to form an input mechanism in which “provincial city synchronization and school-enterprise integration” are built together. The provincial finance allocates part of the funds for project construction. The municipal government allocates some funds. The related industries and enterprises invest a certain amount of funds. Colleges and research institutes provide resources such as talents and technology. This kind of financing method has several advantages: First, it is not entirely funded by the government, which can relieve government financial pressure; Second, the enterprises invest some funds as the principal, which can stimulate the enthusiasm of the enterprises to strengthen innovation; Third, the use of talents, technology and other resources in universities and research institutes as input capital can also effectively promote the organic integration of people, finances, and goods, and stimulate the development of the innovation center.

4.2 Operation Mode

In the mode of operation, there are board of directors and committee system for the foreign manufacturing innovation center, and the domestic one is mainly corporate system. It is formed in the form of "Alliance + Company", which is based on an industrial innovation alliance, set up a limited company a limited company. The company has a shareholders' meeting, and the stronger enterprises in the industry become shareholders. It operates completely according to the marketization mechanism and the enterprises make the decision-making activities autonomously. Anhui province can learn from this mode of operation, relying on universities and research institutes in the province to set up industrial alliance, establish a limited company on the basis of alliance, and absorb strong industrial strength enterprises as shareholders. Set up a shareholders' meeting, a board of directors, and a board of supervisors and a company's operation team shall be set up under the board of directors, which shall be responsible for the daily management and operation of the company. In terms of project implementation, the project manager responsibility system is adopted, and the project manager is responsible for the execution of the project and the realization of the goals. The members of the company are as diverse as possible, including government, enterprises, colleges and research institutes, and non-governmental organizations, such as industry associations, to build a good innovation center with the help of various strengths.

4.3 Sustainable Development Approach

For manufacturing innovation center, sustainability is very important. Sustainable development requires the innovation center itself to have a strong hematopoietic function. The sustainable development of Anhui province's manufacturing innovation center should proceed from the following aspects:

The first is revenue, the innovation center must have a sustainable income model to maintain the normal operation of the center, which requires the enterprise to integrate capital, technology, talent, etc., to grasp the core competitiveness of technology research and development, and to cooperate with the enterprise. Accept the entrustment of enterprises, provide technical services, testing and certification services, transfer and transform research results to achieve self-financing and self-development.

Followed by talent, the key to technology research and development is talent. The innovation center must absorb the participation of universities and research institutes, and transport talents with professional skill and technological R&D capability. Through the screening of new technology and new processes, the innovation center clarifies the skill and talent required for the application of new technologies, unites universities and research institutes, and establishes a talent cultivation mechanism in a targeted manner to achieve the sustainability of the innovation center in terms of talents.

The last are the organizational structure and management. The innovation center should have a stable and complete organizational structure, the company set up the shareholders' meeting, and the directors and supervisors shall be elected by the shareholders' meeting, and set up the board of directors and board of supervisors. The members of the innovation center decision-making body should have extensive representation, including representatives from members, independent and outstanding individuals from the industry and the scientific and technological sector, and be responsible for formulating long-term development strategies, decision-making investment and financing, personnel, and capital construction and other major issues of the innovation center. The daily management and operation of the organization is the responsibility of the board of directors and the executive director, and the execution of the project is the responsibility of the project manager. The board of directors shall be elected by the shareholders, exercising authority on behalf of the shareholders, safeguarding shareholders' rights and interests, and being accountable to shareholders and supervised by the

board of supervisors. For incompetent directors and general managers, they may be replaced or dismissed through the general meeting of shareholders so as to maintain the stability and continuous operation of the company.

4.4 Regional and Industry Distribution

The traditional pillar industries of Anhui province are coal, steel, building materials and other industries. Huaibei mining, Huainan mining, Ma'anshan iron and steel, Tongling coloured and Wuhu conch cement are all the important support for the development of the local industry. However, in recent years, with the adjustment of industrial structure, traditional industries have excess production capacity and lack of growth. On the contrary, a number of strategic emerging industries are booming and growing rapidly, and they are expected to become the new engine for the development of Anhui's manufacturing industry. Among them, Hefei's new energy vehicle, smart equipment, new generation of electronic information, Wuhu's energy-saving and new energy vehicle, intelligent robot, Ma'anshan's new material, Anqing's bio- medicine, Xuancheng's construction machinery, Quzhou's high-end equipment manufacturing etc., are more prominent. In the layout of the manufacturing innovation center, Anhui Province must assess the situation, consider the actual situation of industrial development in various cities, and give priority to industries and regions with comparative advantages. In the area of local manufacturing development, the local cities must adhere to something to be done, focusing on the development of competitive industry, bigger and stronger, to avoid the waste of resources caused by blind competition.

5. Conclusion

With the continuous advancement of China's reform and opening up and the in-depth development of the market economy, Anhui's industrial development is facing both challenges and opportunities. Manufacturing industry is the main body of industry. Anhui province moves from a large manufacturing province to a strong manufacturing province. On the one hand, it must speed up the transformation and upgrading of traditional industry. On the other hand, it must vigorously cultivate and develop strategic emerging industry. In this process, governments, enterprises, universities and research institutes, as well as intermediaries, social organizations and other multiple entities should strengthen collaboration and cooperation to jointly promote the development of Anhui's industry. At present, what Anhui province needs to do is to speed up the construction of a number of provincial manufacturing innovation centers, through the cooperation of multiple subjects, revitalize the traditional industry and strengthen the emerging industry, and truly realize the transformation from large manufacturing province to strong manufacturing province.

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