

Research on the High-Quality Development of Advanced Manufacturing Industry in Xi'an City

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Abstract: In the face of the sweeping impact of the new global economic landscape, China's manufacturing industry has undergone a commendable period of growth and improvement, with the development of advanced manufacturing industries being a development focus for various nations and regions. Recently, Xi'an has made notable strides in its overall economic progress and achievements. However, there still exist areas of concern that require attention, such as industry dispersion and low levels of transformation of scientific and technological achievements. Henceforth, this paper aims to bring together the connotations and characteristics of the high-quality development of advanced manufacturing industries, to clearly identify the gap in Xi'an's advanced manufacturing industry when compared to similar industries in other regions across the country. By doing so, this paper aims to lay the foundation for Xi'an's achieve high-quality growth and development.

1. Introduction

Advanced manufacturing mainly refers to the new form of manufacturing industry formed by continuously absorbing the latest technological achievements, and then applying these advanced manufacturing technologies to the entire process of product research and development, production, and sales in the manufacturing industry [1,2]. Compared with traditional manufacturing, advanced manufacturing has the characteristics of high quality, efficiency, low consumption, cleanliness, and flexible production [1]. It often achieves higher economic benefits and market development effects. At present, the advanced manufacturing industry in Xi'an is developing well, and has formed certain development advantages in fields such as new material energy, optoelectronics, intelligent manufacturing, and automobiles [3]. Xi'an City continuously adjusts its development mode and industrial structure, promotes the upgrading of the industrial structure of advanced manufacturing industry, and promotes the vigorous development of advanced manufacturing industry [3,4].

The high-quality development of Xi'an's advanced manufacturing industry is closely linked to the strengthening of Xi'an's industrial strength. This development can greatly support the efforts to address the weaknesses in Xi'an's physical economy and accelerate the upgrading of the industrial structure [4]. Furthermore, the high-quality development of advanced manufacturing industries will undoubtedly lay a solid foundation for Xi'an to achieve its position as a strong city in the western

region, and promote the more rapid construction of Xi'an as an international metropolis and a national-level central city.

2. Connotation and Features of High-Quality Development of Advanced Manufacturing Industry

Advanced manufacturing industry refers to an advanced manufacturing sector that is highly reliant on core technologies [2]. As such, the development of this industry requires a continuous absorption of high-tech achievements, which are then utilized in the production and manufacturing of products to achieve efficient and information-based production.

In recent years, the high-quality development of advanced manufacturing industry has exhibited some new features. Firstly, the importance of economies of scale for the development of manufacturing industry. Large scale development is essential for demonstrating strong production capacity, and it also suggests greater potential for improvement in scientific research capabilities, which can promote the development of Xi'an's advanced manufacturing industry. Secondly, the trend towards clusterization, as large-scale development in a particular industry or related industries can produce a clustering effect that benefits all involved parties. Thirdly, the potent innovation ability, as the development of advanced manufacturing industry requires continuous technological innovation to stay competitive. As [5] noted, powerful technological innovation is an indispensable element of high-quality development. Fourthly, the focus on green, sustainable development, with low carbon emissions and environmental friendliness being fundamental principles of high-quality development. The promotion of sustainable and eco-friendly development is always a key pursuit of the high-quality development of advanced manufacturing industry. Finally, the emphasis on high conversion rates and efficiency, as advanced manufacturing industry constitutes a high-end value-added industry. To offset the high costs of development, excellent conversion efficiency is essential; otherwise, it will be unsustainable.

3. Achievements in the Development of Advanced Manufacturing Industry in Xi'an

Renowned for its "hard technology", Xi'an set a goal to become a leader in advanced manufacturing at the beginning of 2020. With related implementation opinions released by the government, it is explicitly stated that Xi'an will build a first-class advanced manufacturing industrial system in China. The development plan of Xi'an, issued by the local government, also clearly specifies that Xi'an will build a first-class advanced manufacturing base in the country. Under this guiding principle, Xi'an's government has led the construction of the advanced manufacturing system in the city, focusing on promoting cooperation and interaction among major advanced manufacturing enterprises, other manufacturing enterprises, and production services enterprises. The system aims to accelerate the development of emerging industries, and simultaneously, promote the diversified development of pillar industries while actively supporting service-oriented industries, thereby driving the high-quality development of Xi'an's economic growth collectively.

Under the clear objective, the advanced manufacturing industry in Xi'an has achieved some considerable achievements. According to the Research Report on Top 100 Advanced Manufacturing Cities (2022) released by the Ministry of Industry and Information Technology, twelve cities in western China were on the list, with Xi'an notably among them. Furthermore, from the data of the past five years, the ranking of Xi'an has jumped from 20th in 2018 to 12th in 2022. According to the statistics, the value-added of Xi'an's industrial enterprises with an annual revenue of over 20 million yuan increased by 11% in the first half of 2022, setting the highest growth rate in the same period in the past five years. Xi'an ranked first among all sub-provincial cities and

national central cities. From the data released in the first three quarters of 2022, the investment amount in the 225 advanced manufacturing and R&D platform projects in Xi'an increased by 12.9%, reaching 93.62% of the annual plan.

According to [6], Xi'an has established a robust industry cluster that has exerted a significant impact nationwide. Representative of this achievement is the electronic information industry cluster, headed by advanced manufacturing majors, such as Huawei and ZTE, the high-end equipment manufacturing industry cluster, anchored by enterprises like Shaangu and Xidian, and the automotive manufacturing industry cluster consolidated by Shaanxi Heavy Duty Automobile and BYD. Additionally, Xi'an is a hub for the biopharmaceutical industry cluster, led by enterprises such as Janssen and Libang, and the new materials and new energy industry cluster featuring advanced manufacturers such as LONGi and Western Superconducting Technology. Complementing this array is the aerospace industry cluster, whose core group comprises advanced manufacturing majors like the aerospace base and AVIC Xi'an Aircraft. Amongst these, the aerospace industry cluster has demonstrated a remarkable growth trajectory over the years, standing out in terms of its superseding power, and the cluster has made a name for itself by securing a place on the winner's list in the advanced manufacturing cluster finals organized by the Ministry of Industry and Information Technology.

4. The Main Problems of the High-Quality Development of Advanced Manufacturing Industry in Xi'an

As Xi'an's advanced manufacturing industry continues to grow, it enjoys certain inherent advantages and has achieved notable success. However, certain limitations and challenges have hindered its high-quality development, arising from external factors and internal obstacles.

4.1. Weak Competitiveness of the Real Economy

The scale of Xi'an's industrial sector is relatively small compared to other manufacturing provinces and cities, with fewer enterprises above a certain size. Although some manufacturing firms have exceeded billions in output value, there has yet to emerge a manufacturing giant comparable to the likes of Sany Heavy Industry in Changsha, Intel in Chengdu, or Foxconn in Zhengzhou. National-level development zones and industrial parks in Xi'an are currently characterized by scattered layouts and low local support rates [4]. As such, some of Xi'an's leading advanced manufacturing enterprises have demonstrated weak competitiveness in metrics such as operating income, profits, and other indicators, which have been influenced by factors such as finance, technology, and geography.

4.2. To-Be-Improved Scientific and Technological Innovation Capacity

Xi'an was designated as a national manufacturing innovation center in 2016, and boasts a large number of universities, providing a significant advantage in scientific and technological innovation. However, it is undeniable that since 2010, the proportion of employees in the advanced manufacturing sector has significantly declined. The improvement of scientific and technological innovation capabilities is essential in promoting the development of advanced manufacturing. The talent pool is a crucial factor in enhancing scientific and technological innovation capabilities, given its paramount importance to the industry. According to [7], the declining proportion of employees in the advanced manufacturing sector, and the loss of scientific and innovative talent, will inevitably pose significant obstacles to the improvement of Xi'an's advanced manufacturing sector's scientific and technological innovation capabilities. In addition, inadequate funding for research and

development also poses a challenge to improving scientific and technological innovation capabilities.

4.3. Inadequate Investment in Human Capital

Talent is the foremost resource in the development of the real economy. Promoting high-quality development in the advanced manufacturing industry necessitates the cultivation of high-caliber professionals. In the present scenario, which is characterized by rapid technological advancements in domains such as big data, digitization, and artificial intelligence, the imperative of investing greater human capital in the education and training of qualified candidates cannot be overstated. Although Xi'an city and its surrounding regions boast a considerable number of engineering colleges and majors, as well as an aptitude for nurturing scientific and innovative talents, the inadequate investment in human capital utilization has restricted the retention of qualified professionals, thereby directing a greater number of advanced and innovative candidates towards lucrative opportunities in Beijing, Shanghai, Guangzhou, Shenzhen, and other metropolitan areas. Capital investments in human resources represent a concern not solely for enterprises, but for research institutes and universities as well. When cultivating talented individuals, a commitment to investing greater financial resources, as well as prioritizing the establishment of joint education bases with enterprises to produce candidates well-versed in knowledge and abilities that match the actual needs of said corporations, are paramount.

4.4. Limited Financial Support

Regardless of whether it pertains to boosting technological innovation capabilities or investing in human capital, financial investment is a prerequisite. For the advanced manufacturing industry, the need for funds is larger than that for ordinary manufacturing enterprises, which is why they face greater financial pressures. In recent years, the Shaanxi provincial government has significantly increased its investment in research and development funding to further promote the development of Xi'an's advanced manufacturing industry. Nevertheless, industry coverage imbalances still exist. There have been some deficiencies in personnel investment in the advanced manufacturing industry, and presently financial institutions in Xi'an still encounter significant obstacles in respect to providing financial support for advanced manufacturing projects.

5. The Path of High-Quality Development of Advanced Manufacturing Industry in Xi'an

5.1. Enhancing the Competitiveness of the Real Economy

To enhance the competitiveness of Xi'an's real economy, it is imperative to ensure the stable development of existing ten-billion-yuan enterprises and direct more policies and capital investments towards industries with greater development potential. This approach can provide these enterprises with more safeguards to expand and strengthen their presence in the market. Concurrently, with a steadfast commitment to maintaining the current scale of the real economy, Cao [8] argued that optimizing industrial distribution and advancing technological innovation is necessary. Explicit industrial layout planning can avoid industrial homogenization, which can provoke intra-regional competition among industries, thereby enabling enterprises to invest more in non-duplicative scientific and technological innovation, new technologies, and high-end product manufacturing to compete in the market. Furthermore, Li [9] underscored the importance of paying close attention to research and development, manufacturing, marketing, and after-sales services of new products, and postulated that enterprises need to transition from simple manufacturing to

supply chain collaborations to comprehensively enhance the competitiveness of real economy in Xi'an.

5.2. Enhancing the Capacity for Scientific and Technological Innovation

With the exception of certain industries, the advanced manufacturing industry of Xi'an does not exhibit a distinctive advantage and urgently requires the enhancement of its capacity for scientific and technological innovation, in order to alleviate the inadequacies and shortcomings inherent in the economic development of the region. The lack of high-end products in the advanced manufacturing industry of Xi'an, in comparison to coastal manufacturing enterprises, continues to manifest a significant gap in competitiveness. Consequently, in order to accomplish the goal of narrowing this gap and achieving sustainable development, enterprises within the advanced manufacturing industry of Xi'an should leverage existing advantages by seeking possible pathways for the enhancement of their capacity for scientific and technological innovation. With numerous universities and research institutes located within its vicinity, Xi'an possesses notable advantages in scientific research. As such, Xi'an should utilize this advantage, through the collaboration of its universities and research institutions, to facilitate the comprehensive cooperation between enterprises and academia and research institutions, thus enabling advanced manufacturing enterprises in Xi'an to extricate themselves from the current situation of technologically inferior outcomes and relatively unsophisticated technological processes. This would accelerate the formation of an independent knowledge system that would effectively increase core competitiveness, and facilitate the transformation of current technologies and products into intelligent and innovative ones, thereby realizing the high-quality development of advanced manufacturing industry in Xi'an.

5.3. Strengthening Investment in Human Capital

The high-quality development of advanced manufacturing in Xi'an hinges on a robust strategy for nurturing human capital. To that end, Xi'an must continue to invest significantly in human capital, collaborating closely with universities and enterprises to expedite the development of a system for cultivating high-end innovative talent. It is imperative that Xi'an strengthens investment in universities, ensuring access to cutting-edge technological equipment. For university scholars and researchers, this equipment will provide them with the necessary tools to conduct innovative research and development, enabling the transformation of scientific achievements from the laboratory into practical productivity. Regarding talent attraction and retention, enterprises should contemplate providing various forms of incentives to individuals who have accomplished significant achievements. Furthermore, as recommended by [10], Xi'an can implement policies addressing healthcare, education, housing, and other necessities, mitigating concerns of prospective employees regarding their work and life in Xi'an. The Xi'an government can also consider tax exemptions applicable to personal income tax, reducing the tax burden on innovative talent, and encouraging the attraction and retention of talent in Xi'an.

5.4. Increasing Financial Support

Investment in research funding is crucial for the high-quality development of advanced manufacturing. To this end, the Xi'an municipal government can offer financial subsidies to advanced manufacturing enterprises, specifically earmarked for scientific and technological innovation and research expenditures. The government can also reward enterprises that achieve higher economic performance, promoting innovation in these businesses. As suggested by [11], further reduction of the tax burden on advanced manufacturing corporations would encourage them

to allocate more funds to technology research and development, and promote high-quality growth. The government can put in place related tax incentives through tax exemptions. In addition, expanding the scope of credit services, enhancing financial services tailored to advanced manufacturing businesses, and broadening the guarantee mechanisms can also encourage advanced manufacturing enterprises in accessing financial support [12].

6. Conclusions

In conclusion, the high-quality development of advanced manufacturing in Xi'an is intricately linked to the overall growth of the city's industrial economy, playing a pivotal role in accelerating the upgrading of the industrial structure. Additionally, it will lay the foundation for Xi'an to achieve its status as a leading city in the western region and expedite the transformation of Xi'an into an international metropolis and a national center city.

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