

Local Path Selection for Promoting the Integration and Development of Advanced Manufacturing and Modern Service industries

-- Taking Taiyuan City as an Example

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Abstract

Promoting the integration of the "two industries" is an inevitable product of industrial transformation under the background of the new era of technological revolution. It is an important part of the modern industrial system and also an inevitable choice for Taiyuan City to enhance the core competitiveness of the manufacturing industry, build a modern industrial system, and achieve high-quality development. In 2019, China issued the Implementation Opinions on the Deep Integration of Advanced Manufacturing and Modern Service Industries. Taiyuan City has included the integration of advanced manufacturing and modern service industries (hereinafter referred to as the "integration of the two industries") in the "14th Five Year Plan", accelerated the cultivation of new service-oriented manufacturing formats and models, and continuously promoted the integration of the "two industries". In 2021, the operating income of 129 modern service industry enterprises in the city was 82 billion yuan, and the added value of advanced manufacturing was 68.78 billion yuan, forming a good development trend. This article aims to analyze the gap in the integration of the two industries in the development of Taiyuan City through literature review and questionnaire survey, in order to propose solutions to the problem.

Keywords

Advanced manufacturing, Modern service industry, Integrated development, Path selection.

1. Introduction

The integration of the two industries is a barometer of modern economic development. In the middle and later stages of industrialization, stable economic development depends on the deep integration of manufacturing and service industries. As early as 2004, the added value of service industries in the United States, Britain, France, Germany and other countries accounted for over

70% of GDP. Since China issued the Implementation Opinions on the Integration of the Two Industries in 2019, the integration of the two industries has been rapidly promoted. For example, Nanjing City has provided platforms, established and improved the work mechanism and assessment system for the integration of the two industries. In 2021, the proportion of the output value of high-tech industries in the city's large-scale industries reached 55.1%. Ningbo City in Zhejiang Province, focuses on six major tracks including technology, digital intelligence, and financial services through the integration of the two industries. As of September 2023, it has implemented a total of 343 municipal level digital workshop and intelligent factory projects, and has 63 national level single champion enterprises, ranking first in domestic cities.

Since 1978, although China has created a "world manufacturing factory", it has long been at the low-end of the value chain in the international division of labor system. The integration of the two industries can not only eliminate this unreasonable division of labor, but also achieve more efficient cross-border allocation of industrial resources. The integration results in a 1+1>2 superposition effect. The modern service industry has the characteristics of high specialization and knowledge intensity, while the advanced manufacturing industry combines the characteristics of intelligence, intensive and efficient development. The integration and development of the two industries in the value chain is conducive to promoting industrial synergy, breaking through the fragmentation of industries, and occupying high value-added links in the industry chain. The integration of the two industries can also drive the upgrading of cities and meanwhile effectively rely on development zones, high-tech zones, and productive service industry clusters, focus on key manufacturing industries, innovate and develop service formats, and promote the transformation and development of enterprises. Meanwhile, it can promote the service industry to leverage its data-driven advantages, expand its applications in the manufacturing sector and promote the diversified integration of strategic emerging industries and modern service industries. It can also cultivate new formats and models such as personalized customization and full life cycle management, persistently changing urban population and industrial structure, driving a significant increase in livable and business friendly environment, transforming cities from traditional industrial to modern ecological. Some developed countries have also put forward many excellent cases in the integration and development of advanced manufacturing and modern service industries.

Germany proposed the concept of Industry 4.0, which integrates manufacturing with information technology and promotes digital, automated, and intelligent manufacturing. By introducing technologies such as the Internet of Things, cloud computing, and artificial intelligence, the German manufacturing industry has achieved high flexibility and personalized customization in the production process, improving production efficiency and product quality. In addition, Germany also focuses on cultivating technical talents and promoting cooperation between industry and academia, promoting the transformation and upgrading of the manufacturing industry. Silicon Valley, Boston, and Seattle in the United States have become world-class centers of technological innovation. These regions gather a large number of high-tech enterprises, research institutions, and start-up companies, It covers multiple fields such as hardware manufacturing, software development, artificial intelligence, biotechnology, etc., forming a complete innovation ecosystem. Japan's robotics technology is widely used in the manufacturing and service industries, including industrial robots, medical robots, and service robots. This integration has also created new service businesses and business models. London has become one of the world's leading financial technology centers. Financial technology integrates financial services with information technology, providing more convenient and efficient financial solutions through innovative digital payments, online lending, intelligent investment and other services. The collaboration between high-tech companies in London and traditional financial institutions has driven innovation and transformation in the financial industry. These countries focus on technological innovation, industrial collaboration, talent

cultivation, and policy support, providing a favorable environment for the integration of advanced manufacturing and modern service industries.

2. Literature Review

2.1 In recent years, the study of the strategic path of coal industry has become an important research topic in the fields of economics and management. Gebauer, H., & Fleisch, E. (2007) explored the integration of manufacturing and service activities early on. It studies how enterprises can establish collaborative relationships between manufacturing and service industries. Neely, A., Benedettini, O., & Visnjic, I. (2019) studied the trend of service-oriented manufacturing. It analyzed the key trends and interdependent factors of serviceization, and summarizes and evaluates relevant research. Yang Xiaojun, Xu Jianhua, Liang Bo (2019) made a comprehensive review and outlook on the integrated development of advanced manufacturing and modern service industries, exploring the trends, driving forces, and influencing factors of integration. Fritsch, M., & Piontek, M. (2019) reviewed the service-oriented process of manufacturing enterprises and explored past, present, and future development trends. It provides an understanding of the historical evolution and key driving factors of service-oriented manufacturing enterprises. Gebauer, H., Paiola, M., & Edvardsson, B. (2018) reviewed and compared the research fields of digitalization and service-oriented services. It explores the impact of digitization on service-oriented research, as well as research findings and perspectives across different research genres. Wang Zhangyan (2018) pointed out that different paths have different impacts on the development of enterprises, and the anger communication path has advantages and disadvantages. Tukamuhabwa, B. R., Stevenson, M., Busby, J. (2020) analyzed the impact of advanced manufacturing technology on service-oriented practices and provided an overview and evaluation of related research. Zhou Baolei, Zhu Yongwei (2020) believes that the key issues for the integration and development of advanced manufacturing and modern service industries include challenges in organizational structure, human resources, technological innovation, and other aspects. Gebauer, H., Gustafsson, A., & Witell, L. (2011) explored the issue of manufacturing companies achieving competitive advantage through service differentiation. It studied the impact of service differentiation on enterprise competitiveness and provided relevant practical suggestions. Guo Borong, Li Zhiyong, Li Ruirui (2020) analyzed key factors such as policy support, organizational change, and technological innovation. Zhang Jintao, Yang Xiaofeng, Guo Jin (2021) also explored evaluation indicators and key paths for integrated development. Wang Yong, Zhang Jinpeng, Liang Xiaohui (2021) pointed out the research on innovative models and paths for the integration and development of advanced manufacturing and modern service industries. Explored the impact and development path of innovative models on integrated development. Oliva, R., & Kallenberg, R. (2003) studied management issues in the process of transitioning from product to service. They explored the challenges faced by enterprises in the process of transformation and provided practices for managing this transformation.

2.2 Diagram

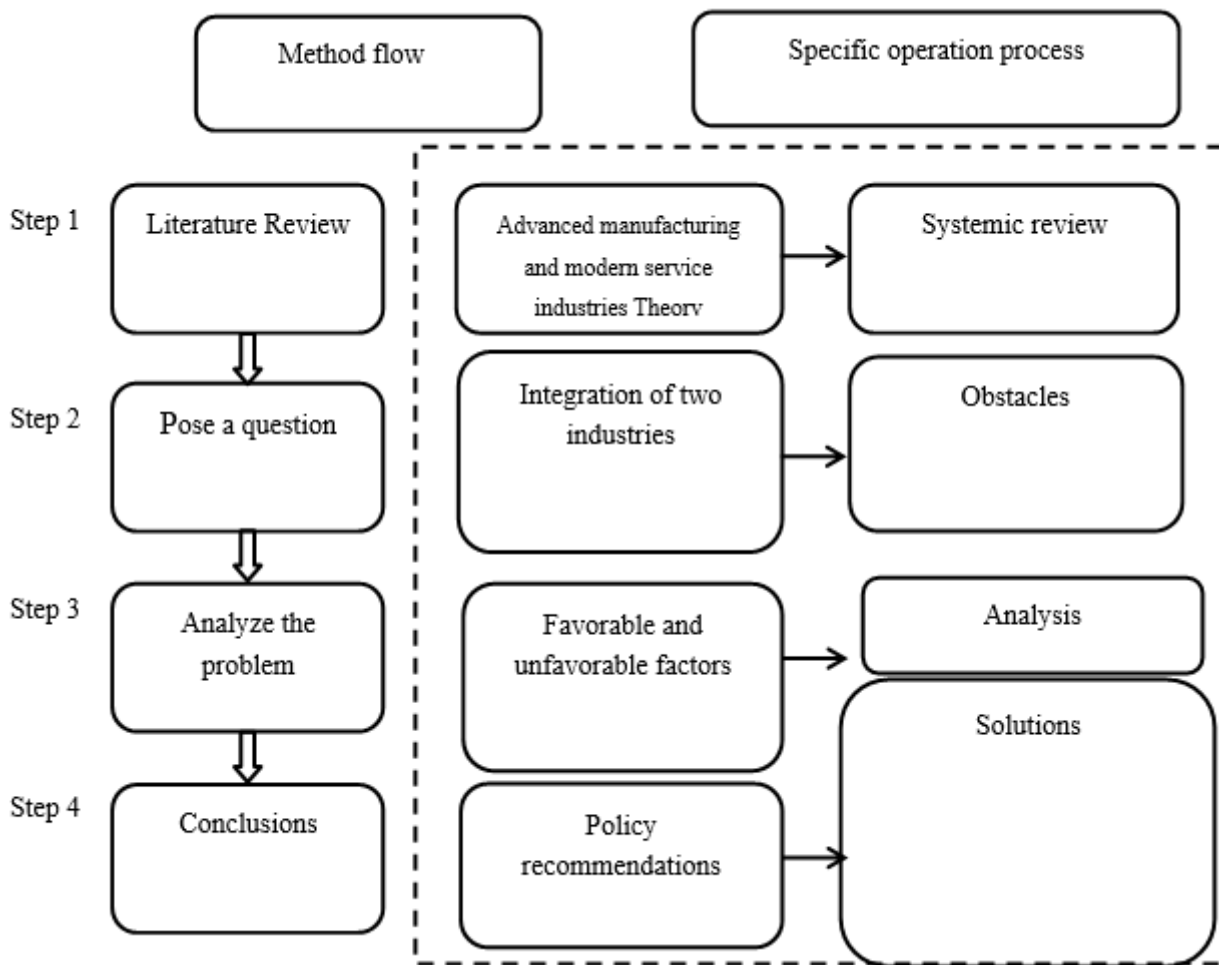


Figure 1. The research framework

3. Analysis and Results

3.1 The Realistic Dilemma of the Integration of "Two Industries" in Taiyuan City is the lack of overall planning. The overall integration of the two industries is still in its early stages. Research has found that the guiding documents for promoting the integration of the two industries are still the implementation opinions jointly issued in 2019. Taiyuan city has not yet introduced a practical and effective policy system based on their own actual situation, which reflects that the municipal government and relevant departments have not put the integration of the two industries on an important agenda, and have planned and actively promoted it as a whole. At the same time, the public service capacity supporting the integrated development of the "two industries" in the city is insufficient, such as insufficient support for talents, funds, and other factors. There is a shortage of composite talents who understand both manufacturing and service, insufficient exploration of new industrial land and functional mixed land use models. There are few specialized public service institutions, think tanks, and innovation sharing platforms in the city, and the environmental atmosphere for promoting the integration of the "two industries" has not yet formed.

3.2 The second is the insufficient endogenous driving force for the integration of the two industries. On the one hand, the driving force of advanced manufacturing industry is insufficient. In 2021, the proportion of traditional industries to the added value of large-scale industries reached 54.7%. The strategic emerging industries and high-tech manufacturing involved in advanced manufacturing industry are generally small in scale and low in output

value. The large demand for industrial upgrading and technological investment in advanced manufacturing industry itself cannot be effectively released, which cannot drive the corresponding integration and development of productive service industry. On the other hand, the supporting capacity of the productive service industry is insufficient. For-profit service industry in Taiyuan mainly consists of emerging service industries such as the Internet and related services, software and information technology services, and technology services, accounts for only about 13% of the total service industry, which cannot effectively support the high-quality development of the manufacturing industry. The development of industrial internet is still in its early stages, with few typical industrial internet platforms and application cases. Only a few enterprises such as Elite Smart Company have obtained national pilot demonstrations, which cannot form an influential driving and demonstration effect.

3.3 there is a lack of typical demonstration and driving force. Since 2020, the National Development and Reform Commission has identified 40 regions and 80 enterprises as pilot areas for the integration of the two industries. However, in Taiyuan, only the Comprehensive Reform Demonstration Zone and Yangmei Chemical Machinery have been recognized as the first batch of national pilot areas and pilot enterprises for the integration of the two industries. This is in contrast to the extensive pilot work of the integration of the two industries in multiple cities across the country, such as Changsha, Zhengzhou, Ningbo and Qingdao. There is a serious lack of benchmarks for the development of the integration of the two industries. At the same time, most enterprises lack awareness of the integration and development of the "two industries". Through research on 30 manufacturing and information technology service enterprises in Taiyuan, it is generally found that there is insufficient and unclear understanding of the integration of the "two industries", and the digital foundation of enterprises is weak.

3.4 The implementation path to promote the integration of "two industries" in Taiyuan City. Accelerating the integration of the two industries is of great significance for promoting the transformation of traditional industries and achieving high-quality development in our city. We should focus on top-level design, formulate precise and highly operational policy systems, establish and improve innovative institutional mechanisms, and form an overall driving force for the integration of the two industries.

3.4.1 Improve the policy system. The integration of the two industries is an advanced form of industrial development, and efforts must be made on the word "integration". It is recommended that based on the relevant policies already introduced, the government should draw on the experience of Changsha and other places in Hunan Province, focus on development zones and industrial parks, adhere to the direction of high-end, intelligent, and green development, clarify development ideas and goals, start from the "six major industrial chains" of Taiyuan's layout, study and formulate a policy system for the deep integration of the "two industries", from the four dimensions of integrated development environment, ability, effect, and efficiency, incorporate the integration of "two industries" into various spatial and economic development plans, and formulate policy guidelines for supporting factors such as the main body, platform, and elements to promote the integration of "two industries". Construct a comprehensive evaluation index system, form a road map and promotion table, and promote the in-depth development of "two industries" integration.

3.4.2 Establish a pilot demonstration system for integrated development. In response to the problem of limited benchmarks for integrated development and insufficient demonstration and guidance, following the selection of advanced manufacturing and modern service industry integration pilot projects by the National Development and Reform Commission, the government should carry out city level pilot projects, select several backbone enterprises and industrial parks with good foundations and distinctive characteristics, encourage pilot units to explore and innovate in management models, public service platform construction, industry standard formulation, and other fields, and form a national level leading force.

3.4.3 Improve the quality of public service supply. In response to the relatively lagging public services related to the top-level planning and design, technological innovation, industrial cultivation, and application promotion of integrated development, it is recommended that the government guide the establishment of public service carriers such as Industrial Internet Innovation Centers and Digital Transformation Promotion Centers. Through cooperation with national think tanks, actively introduce technology and talent resources, and encourage relevant public service institutions to establish market-oriented cooperative operation mechanisms, enhance sustainable operational capabilities and gradually establish an effective high-quality public service support system. Secondly, it is recommended to strengthen the professional public service capacity construction of the Integrated Economic Zone etc., with a focus on promoting the unified investment of basic data, research and development design and other platforms with high construction costs by the development zone, sharing scientific research service capabilities, reducing the R&D investment of individual enterprises, and enhancing the innovation and R&D drive of enterprises. The third is to optimize the public service platform. Encourage the development of common technology research and development, product quality testing, and other services around the "six industrial chains", support the construction of a number of public technology service platforms, strengthen industry university research cooperation, and provide public services such as technology research and development, achievement transformation, quality management, and entrepreneurship incubation for enterprises within the chain.

3.4.4 Expand the stock of advanced manufacturing industry. Advanced manufacturing is the cornerstone of the integrated development of the two industries. In view of the weak foundation of the city's advanced manufacturing industry, the first is to speed up the implementation of the standard of the integration of industrialization and industrialization management system and the data management capability maturity assessment (DCMM) of traditional enterprises, widely organize publicity and training, and improve the progressiveness of enterprise management. The second is for traditional enterprises or attracting large foreign enterprises to strengthen the application of digital technology to traditional enterprises, leverage the amplification, superposition, and doubling effects of digital technology, promote digital transformation and intelligent manufacturing upgrading of enterprises, and continuously enhance the initiative and consciousness of enterprises in advanced and applicable technology transformation and high-tech research and development. Thirdly, relying on the policies already introduced and soon to be introduced for the integration of the two industries in the city, we will actively support traditional enterprises to gradually extend into the high value-added range of the industrial chain. Through penetration into creative development, industrial design, technological research and development, achievement transformation, testing and evaluation, marketing services, and other links, we will continuously expand new spaces for industrial upgrading and new paths for value appreciation. Through the evolution and transformation of management, technology, and products, more enterprises are willing, daring, and able to transform, continuously expanding the scale of advanced manufacturing industry, and driving the growth of modern service industry through the development of advanced manufacturing industry.

4. Conclusion

4.1 Optimize the increment of productive service industry. In response to the weak basic support capacity of city's productive service industry, the first is to improve the digital level of existing service industries, rely on leading information technology service enterprises such as the cloud era to continuously enhance product competitiveness and professional service levels, and further develop towards ecological and platform oriented enterprises; Support small and

medium-sized service enterprises to deepen their cultivation in specific fields and move towards the direction of "specialization, precision, uniqueness, and novelty". The second is to increase the recruitment and landing of external productive service enterprises, especially new generation information technology service enterprises such as industrial internet, strengthen the connection with national cross industry and cross domain industrial internet platform enterprises, enhance the comprehensive ability of local service industry enterprises through government matchmaking support and independent cooperation of enterprises, promote the marketization of productive service industry, and provide strong momentum for the development of advanced manufacturing industry. The third is to build a logistics public information system, establish a logistics public information service system that integrates effective data in the fields of energy, raw materials, food circulation, etc., and improve the level of logistics informatization development.

4.2 Cultivate integrated development platforms. In response to the lack of large platforms and insufficient awareness of enterprise collaboration and integration in the process of integrating the two industries, it is recommended that the government should fully utilize the important development opportunities of the ten key "industrial chains" and ten professional towns in Shanxi province, seize the policy window, and play the resonance role of effective markets and promising governments. Relying on key industrial chain owners, so we can build a platform for the integration of "two industries" and a "double innovation" service platform and encourage chain owners to actively open data entry points to small and medium-sized enterprises in the upstream and downstream of the industrial chain. Through resource rental, service provision, and integration of industry and finance, data information, computing power, and innovative resources can be shared, the cost of digital technology application can be reduced.

4.3 Strengthen the leadership of industrial design. By implementing a special action, we can enhance the design capabilities of the manufacturing industry, rely on leading enterprises to strengthen basic research and key common technology research and development in industrial design, cultivate or introduce leading industrial design enterprises, and build industrial design centers. We can promote the application of new technologies and concepts such as VR/AR, artificial intelligence, and virtual reality in the field of design, and actively develop new models such as cloud design and collaborative design. That building an industrial design competition platform, encourage enterprises to participate in domestic and international industrial design competitions, achieve integration between design and manufacturing enterprises is also needed.

5. Discussion

There are still some shortcomings in this article as follows:

5.1 The connection with practical applications is not yet close enough. There is a significant gap between research results, theoretical models, and practical operations, and more empirical research and practical cases are needed to verify the feasibility and effectiveness of the theory.

5.2. Existing research mainly focuses on the macro level, focusing on the integration trend and policy support of advanced manufacturing and modern service industries in the macroeconomic environment. However, there is relatively little research on the micro level, lacking in-depth analysis of specific enterprises and industries, as well as exploration of practical problems and challenges in the integration process.

5.3 The integration of advanced manufacturing and modern service industries involves multiple disciplines, including engineering technology, economics, management, information technology, and so on. However, this study often faces disciplinary barriers and lacks interdisciplinary integration and communication. It is necessary to strengthen cooperation

between different disciplines, promote the sharing of knowledge and experience, and promote the comprehensive development of integrated research.

5.4 The integration of advanced manufacturing and modern service industries exhibits differences in performance and development patterns across different industries and regions. The existing research is limited to the case study of Taiyuan, lacking comparative analysis and comprehensive research between different industries and regions. Further research is needed on the integration models and experiences of different industries and regions to promote the comprehensiveness and universality of integrated development.

5.5 Incomplete data and indicator system. The data source for the integration research of advanced manufacturing and modern service industries comes from official statistics and field research. In the next step of research, we will establish a comprehensive data collection and measurement system to provide more accurate and comprehensive data support, and conduct relevant indicator research to evaluate the integration effect and economic impact.

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