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Research on Development of Software Industry and Intelligent Industry in Taiyuan City

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ABSTRACT

This research report focuses on the theme of development of software industry and intelligent industry in Taiyuan City. Through on-site inspections of local enterprises in Taiyuan and demonstration parks and innovation bases in advanced areas such as Beijing, Suzhou, Wuxi, and Nanjing, the current situation, existing problems, and future paths of software and intelligent industry development in Taiyuan City are analyzed. The report points out that Taiyuan City has achieved certain results in policy support, infrastructure, and talent cultivation, but compared with developed areas, there are still problems such as incomplete industrial ecology, small enterprise scale, insufficient cross-border integration, and talent shortage. To this end, the report proposes suggestions such as strengthening top-level design, optimizing industrial layout, focusing on key areas (such as artificial intelligence and industrial software), and improving element guarantee. It also draws on the experience of Suzhou Nano city, Wuxi Xue Lang Town, Nanjing Software Valley, etc., to provide feasible solutions for Taiyuan to build a new highland for the development of software and intelligent industries in the central region.

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Introduction

The rapid advancement of digital technologies, particularly in software and artificial intelligence (AI), has become a key driver of economic transformation and industrial upgrading worldwide. In China, the development of the software industry and intelligent technologies is considered a national strategic priority. Against this backdrop, Taiyuan, as the capital of Shanxi Province, has actively embraced digital transformation to foster high-quality economic growth. However, compared to leading cities such as Nanjing, Suzhou, and Shenzhen, Taiyuan still faces challenges in industrial ecosystem development, technological innovation, and talent retention.

This research report investigates pathways to accelerate software industry upgrading and promote intelligent industrial development in Taiyuan. Through field research on local enterprises-such as Dawei Laser and Jingying Digital Intelligence-as well as comparative studies of advanced industrial parks like Beijing's Zhongguancun, Suzhou Industrial Park, and Nanjing's Software Valley, this report identifies Taiyuan's current progress, gaps, and opportunities in digital and intelligent industries. Key findings indicate that while Taiyuan has made strides in policy support, infrastructure (e.g., 5G networks and computing centers), and industrial applications (e.g., smart mining and healthcare), it still lags in areas such as Industrial ecosystem maturity – Compared to cities like Nanjing (with over 4,300 software firms and ¥800 billion in revenue), Taiyuan has only 98 major software companies (2023); Cross-sector integration – Limited penetration of AI and

software technologies in traditional manufacturing, agriculture, and services, Talent attraction and retention – Despite local universities (e.g., Taiyuan University of Technology) offering AI and big data programs, high-skilled professionals often relocate to more developed regions.

To address these challenges, this report proposes strategic recommendations, including:

Enhancing top-level design – Establishing a provincial-level digital economy leadership group to improve policy coordination; Optimizing industrial clusters – Developing specialized software parks (e.g., Taiyuan Software Valley) and fostering key sectors like industrial software and AI; Expanding application scenarios – Promoting smart city initiatives, intelligent mining, and digital governance to stimulate demand for software solutions; Strengthening talent and financial support – Introducing incentives for high-skilled professionals and increasing funding for tech startups.

By leveraging successful models from Suzhou's Nano City, Wuxi's Xue Lang Town, and Nanjing's Software Valley, Taiyuan can position itself as a regional hub for software and intelligent industries. This report aims to provide actionable insights for policymakers, industry leaders, and researchers to drive sustainable digital economic growth in Taiyuan and beyond.

Literature Review on Software Industry Upgrading and Intelligent Industry Development

Global Trends in Software and Intelligent Industries

In recent years, the global software industry has experienced

accelerated development. Argue that digital technologies are driving the Fourth Industrial Revolution, with software as the core engine reshaping the global economic landscape. According to the OECD (2021) report, global software market revenue reached \$1.5 trillion in 2020, with an annual growth rate exceeding 10%. The industry is undergoing three key transformations:

Cloud Computing and Service-Oriented Transition

Highlights that cloud-native architectures are becoming mainstream, with over 70% of enterprises adopting hybrid cloud strategies [1].

Deep Integration of AI Technologies

Emphasizes that AI-powered software is penetrating vertical industries, with the AI software market projected to grow at a CAGR of 25% [2]. Convergence of Software and Hardware.

China's Software Industry Development

China's software industry has maintained rapid growth. The MIIT (2021) reports that China's software revenue exceeded ¥8.16 trillion in 2020, accounting for 25% of the global total. Three characteristic development models have emerged: Innovation-Driven Clusters (e.g., Nanjing): With 4,300 software enterprises and ¥800 billion revenue (Jiangsu Government, 2022), Nanjing demonstrates how policy support (e.g., talent incentives, R&D subsidies) fosters ecosystem development. Application-Oriented Zones (e.g., Suzhou Nano City): Specialized industrial parks integrate upstream/downstream chains, hosting 500+ companies with 130 high-tech enterprises. Manufacturing-Embedded Hubs (e.g., Wuxi Xue Lang Town): By connecting 20+ academicians and 200+ industrial firms, it achieves ¥20 billion output via industrial internet platforms (Wuxi Government, 2023).

Critical Challenges

Despite Progress, Three Key Challenges Persist

Talent Shortages: The mismatch between education outputs and industry needs results in a 30% gap in AI/software engineers.

Fragmented Innovation: Small firms (80% with <¥50 million revenue) lack R&D capacity for core technologies like OS/databases (MIIT, 2021). **Weak Ecosystem Integration:** Only 15% of traditional manufacturers deeply integrate industrial software.

Policy Implications

Effective Interventions Include

Talent Policies: Nanjing's "Purple Mountain Talent Plan" reduced brain drain by 40% (Jiangsu Government, 2022).

Industrial Coordination: Suzhou's public service platforms increased SME innovation efficiency by 35% (Suzhou Bureau, 2023).

Financial Support: Venture capital for software startups grew 200% in AI hubs (OECD, 2021).

Results

The Development Trend and Enlightenment are as Follows:

Currently, from the perspective of global and even national development status, the mode and efficiency changes brought by information technology to production and life will continue to maintain a medium to high growth rate in the software market. The transformation and penetration of software into social management, production labor, education and medical development modes will become increasingly profound.

A series of new economic growth points are emerging, driven by the software industry. Software and information technology services have moved away from their original segmented industry fields, focusing on digital technologies such as big data, cloud computing, blockchain, Internet of Things, and virtual reality, accelerating their penetration and integration into various industries and fields, promoting new industries, new formats, and new business models, leading multi domain, multi-dimensional, and deep level changes, and widely expanding market demand boundaries.

A shift is occurring in the software industry, marked by cloud transformation, enhanced software-hardware collaboration, and a move toward service-based pricing. New applications such as cloud operating systems, cloud artificial intelligence applications, and remote work are constantly emerging, and the integration of software and hardware is becoming increasingly close. Smart cities, industrial Internet, Internet of Things, browser-based netbooks, wearable devices VR New products and applications such as the Internet of Vehicles have highlighted the empowering and intelligent role of software in hardware products, and the demand trend for collaborative development between the software and hardware industries has become increasingly prominent. In addition, under the trend of cloudification and mobility, the software industry is gradually moving towards service-oriented transformation, with innovative methods such as pricing, delivery, updates, and maintenance. In the process of software service-oriented transformation, new formats and products such as data annotation are emerging.

Emerging technologies, including artificial intelligence and 5G, have spurred the development of numerous innovative applications. Continuously expanding cross-border integration boundaries, faster, lower latency, and more intelligent digital new applications and services are constantly developing, completely changing people's work and lifestyle. At present, artificial intelligence has penetrated into various industries. With the gradual maturity and commercialization of advanced artificial intelligence and analytics, edge artificial intelligence, interpretable artificial intelligence, artificial intelligence platform-as-a-service and other technologies, artificial intelligence will promote integrated development on a larger scale, and a wide range of application scenarios will provide broad space for the development of software and information technology services.

Highlighting the guarantee of key elements and improving the industrial innovation ecosystem. Innovate software service models, guide software enterprises to develop towards cloudification, platformization, and servitization, and form an intelligent industrial ecosystem of platform, data, application, service, and security collaborative development.

Strengthen policy guarantees and effectively implement policies that benefit enterprises. Ensure that policies directly reach enterprises. Introduce policies and measures to support the development of integrated circuits, integrate national and provincial preferential policies for industries such as big data, cloud computing, and electronic information, arrange special government funds and industrial development funds, and tilt towards software enterprises that have landed in Taiyuan Software Park. Secondly, it is necessary to establish a sound policy evaluation feedback mechanism, collect feedback from enterprises in a timely manner, and make timely adjustments and improvements. We should actively explore flexible supervision and governance models for intelligent enterprises, and provide more space and time for market entities to explore, try, and self-

regulate from the perspectives of legal regulation, self-regulation, and social regulation.

Strengthen talent drive and introduce digital elite talents. Develop special policies to build intelligent industry clusters, expand the autonomy of talent research, refine the standards for talent recognition in the field of intelligence, and gather and develop outstanding talents and teams from home and abroad. Support the construction of an international talent city in Taiyuan, create a comprehensive service platform that integrates government, enterprise, social organization, and professional talent information resources, and attract high-level talents. Encourage enterprises and universities to jointly develop enterprise university plans, establish joint colleges, joint laboratories, joint projects, holiday training camps, internship bases, etc.

Strengthen market drive and vigorously cultivate the application market. Actively play the role of Huairou Laboratory Shanxi Base, Shanxi Energy Internet Research Institute, Jinchuanggu and other scientific and technological achievements transformation, and build a cross industry and application transformation intelligent industry service platform for the intelligent industry cluster. Explore the integration of intelligent service models into government procurement, gradually promote the application of information technology in small and medium-sized enterprises, communities, and rural areas, and provide data services to enterprises and the public.

Strengthen financial leverage and actively expand financing channels. Establish a province wide intelligent entrepreneurship investment guidance fund as soon as possible to promote the attraction of industrial investment funds and venture capital institutions to invest in seed stage and start-up stage intelligent enterprises in Taiyuan Intelligent Industry Agglomeration Zone; Establish a cloud computing intelligent industry venture capital fund to provide equity investment, venture capital, and entrepreneurial management services for start-up enterprises. Guide and encourage financial institutions to provide credit support for the big data industry, with a focus on supporting the construction of infrastructure such as data centers, public service platforms, fiber optic networks, and big data application projects.

Strengthen external promotion and deeply integrate the resources of Beijing and Tianjin. Taking advantage of its proximity to Beijing, with a focus on Zhongguancun Science and Technology Park and Yizhuang Economic and Technological Development Zone, we aim to attract software companies to develop in Taiyuan Intelligent Industry Agglomeration Zone and promote the industrialization transfer of their independent innovation achievements; Encourage joint application with Zhongguancun Research Institute and other institutions for cloud computing and software technology industrialization projects of the National Development and Reform Commission and the Ministry of Industry and Information Technology. Targeting cutting-edge technologies and applications of big data, attracting big data enterprises, research institutions, and industrial organizations from innovative frontier areas such as Zhongguancun to settle in Taiyuan Intelligent Industry Agglomeration Zone [3-15].

Conclusion

Although Taiyuan has made some achievements in the development of software and intelligent industries, comparing the trend of industry development and looking at our own development achievements, it can be seen that more of them are achieved spontaneously rather than consciously, which clearly reflects the gap or shortcomings between software and intelligent industries.

The planning efforts for the industrial development system need to be increased, and the ecological system is not yet perfect.

Although our city has established a digital economy development leadership group led by the mayor and introduced relevant policies and measures, compared to cities such as Nanjing, Hangzhou, and Shenzhen, system design for promoting the development of software and intelligent industries is insufficient in Taiyuan City, lacks forward-looking foundations, and supporting policies need to be improved. To some extent, the special funds and supporting measures at the provincial level are still insufficient, and there are gaps in the implementation and implementation of some policies, resulting in weak sense of achievement for enterprises.

The industrial layout needs to be optimized and the scale of enterprises is small. The layout of software technology enterprises in Taiyuan City is unreasonable, generally small, lacking core technology and independent intellectual property rights, weak basic research and core technology capabilities, and a small number of basic software, supporting software, and industrial software products. Most enterprises rely on system integration business and provide information and software operation and maintenance services to survive. This is in stark contrast to advanced cities such as Hefei, where there will be 642 large-scale software enterprises with a revenue of 100 billion yuan in 2023, far higher than Taiyuan's 98 households with a revenue of 3.71 billion yuan.

Cross-border integration needs to be deepened and the development focus is not prominent. Although the software and information technology service industry has formed a certain foundation in the development of government, commercial, and civilian use, the overall application level is not high and the integration is not deep. The integration of the software industry with manufacturing, agriculture, and service industries is insufficient, and the integration of research and development design, production management, key equipment, and other links is still a weak link, with a lack of shared platforms. In addition, the development and utilization of data resources are insufficient, and innovative applications based on big data are still inadequate.

The support capacity for service talents needs to be improved, and there is a shortage of professional talents. Although Taiyuan has Taiyuan University of Technology, Shanxi University, Central North University and other local colleges and universities to train computer and software related professionals, the structural contradiction of talent is prominent. Faced with the situation that local talents cannot be retained, foreign talents are few, and software professionals are scarce, in particular, there is a lack of compound talents who understand both digital technology and industry business, have Internet thinking and are familiar with manufacturing.

Discussion

The rapid development of AI and 5G technologies has significantly accelerated innovation across industries, as demonstrated by our analysis. These technologies not only enhance existing applications (e.g., smart manufacturing and autonomous systems) but also enable entirely new use cases, such as real-time edge AI and immersive AR/VR experiences.

Our findings align with prior studies highlighting 5G's role in reducing latency and AI's capacity for data-driven decision-making. However, we further identify that the synergy between AI and 5G—rather than their isolated impacts—is the key driver of breakthroughs, a nuance less emphasized in earlier literature. From a practical perspective, this trend necessitates updates in policy frameworks (e.g., data governance) and infrastructure

investment to fully harness the potential. Challenges such as energy consumption and ethical risks in AI deployment remain critical barriers. Future research could explore sustainable implementations or quantify the economic impact of these convergent technologies.

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