

Agglomeration of Producer Services and Digital Transformation of Enterprises

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Abstract

In the process of rapid industrialization in China, along with the increasingly significant spatial agglomeration trend of the manufacturing industry, the producer service industry separated from the manufacturing industry also shows obvious spatial agglomeration characteristics, which has become an important breakthrough to reshape the new advantages of economic development in the context of the new era. At the same time, in the context of the rapid development of the digital economy, digital transformation has become a strategic choice for enterprises to upgrade and improve their management and win competitive advantages in the future. This paper studies the degree of agglomeration of producer services in the urban agglomeration of the middle reaches of the Yangtze River and the corresponding digital transformation process of enterprises, and the results show that: first, the agglomeration of producer services has a positive effect on the digital transformation of enterprises. Second, the allocation of human capital and innovation factors is a key way for the agglomeration of producer services to promote the digital transformation of enterprises. Third, the digital transformation of enterprises has significantly improved the level of servitization of enterprises, which in turn has promoted the agglomeration of producer services. The above research results imply that the government should strengthen top-level design to promote the agglomeration and industrial integration of producer services; Formulate differentiated policies according to regional conditions and enterprise characteristics, and provide targeted assistance; Strengthen talent training, take advantage of the agglomeration of producer service industries, strengthen regional talent exchanges, strengthen cooperation among innovation entities in the agglomeration area, promote the integration of talents and other innovation resources, promote the construction of collaborative innovation ecology, and further promote the digital transformation of enterprises.

Keywords

Producer services, agglomeration, digital transformation of enterprises.

1. Introduction

At present, although China's manufacturing industry occupies an important part of the global manufacturing industry, the high-end manufacturing field is unable to make fundamental breakthroughs in core and key technologies due to foreign technology monopoly and blockade. This requires the manufacturing industry to drive innovation-driven development, continuous transformation and upgrading, and improve innovation efficiency, so as to enhance the international competitiveness of the manufacturing industry and help "Made in China" to "Made in China" to move forward rapidly. As an intermediate input industry separated from the production service sector within the manufacturing industry, the producer service industry has

become an important part of the global value chain of the manufacturing industry and the "propeller" of its innovation and development. In short, the high-quality development of the manufacturing industry is inseparable from the support of the producer service industry. In view of the fact that inter-industry agglomeration not only shortens the spatial distance, but also provides opportunities for interactive learning with each other, the industries with spatial agglomeration can stimulate innovation vitality and achieve innovation output more than the industries under their own isolation.

At the same time, the digital economy has become an indispensable and important force driving the stable growth of China's economy. According to the estimation of relevant institutions, the scale of China's digital economy has reached 39.2 trillion yuan in 2020, accounting for 38.6% of GDP, a year-on-year increase of 9.7%; Among them, the scale of industrial digitalization reached 31.7 trillion yuan, accounting for 31.2% of GDP, a year-on-year increase of 10.3%. In the era of digital economy, accelerating the process of digital industrialization and industrial digitization, and promoting the deep integration of the digital economy and the real economy, is the only way to achieve high-quality economic development. Enterprises are an important micro foundation in the market economy, and promoting the digital transformation of enterprises is conducive to transforming and upgrading the traditional kinetic energy of enterprises and cultivating new kinetic energy of enterprises, thereby promoting the development of the digital economy. It is of great theoretical value and practical significance to further improve the scale and quality of enterprise digital transformation and promote economic transformation and upgrading under the new development pattern with digitalization.

In view of this, this paper fully absorbs the existing main research results and deeply explores the interaction mechanism between the agglomeration of producer services and the digital transformation of enterprises. The possible innovations of this paper are: first, to refine the research perspective, this paper integrates industrial agglomeration and enterprise digital transformation into the same theoretical analysis framework, and systematically examines the relationship between industrial agglomeration and enterprise digital transformation, so as to open up a new perspective for the research field of industrial agglomeration effect. Second, it is necessary to innovatively study the mechanism between the agglomeration of producer services and the digital transformation of enterprises, fully understand the role of agglomeration of producer services in the digital transformation of enterprises, and help more small and medium-sized manufacturing enterprises to promote the digital transformation of enterprises. Thirdly, the main content of this study can provide new ideas for academic research and provide a theoretical reference for government departments to make decisions to promote the agglomeration of producer services and the digital transformation of enterprises.

2. Literature Review

For example, Marshall's (1920) external economic theory believes that industrial agglomeration is mainly caused by three factors: labor market sharing, intermediate product input and specialized market, while Henderson et al. (1998) mainly based on the analytical framework of economic geography believe that the cause of industrial agglomeration is mainly caused by the difference of economic geographical factors. With the rise of new economic geography represented by Krugman et al., the study of industrial regional agglomeration has made rapid progress since the 90s of the 20th century by incorporating spatial factors such as "iceberg" transportation costs into the general equilibrium analysis framework (Krugman, 1991a; Kim, 1995; Hanson, 2001). However, a large number of domestic literatures on industrial agglomeration basically comprehensively consider the above three theoretical analysis frameworks, and prove the feasibility of this theory in China with Chinese experience, such as Jin Yu, Chen Zhao and Lu Ming (2006) and Yang Hongjiao (2008).

At the same time, we can also see that the current research on industrial agglomeration is mainly focused on the field of manufacturing, with the transformation of the world economy from the "industrial economy" to the "service economy" and the development of the social division of labor and the improvement of the level of specialization, the service industry, especially the producer service industry, is gradually separated from the original manufacturing function through outsourcing, so that the agglomeration effect of the service industry gradually appears. Cheng Dazhong and Chen Fujiong (2005) discussed the regional and sectoral differences in the relative intensity of China's service industry and its sub-sectors on the basis of the structural industry relative intensity index, and believed that this relative intensity has a significant positive impact on its own labor productivity except for the real estate industry, thus confirming the "Verdun law". At the same time, Cheng Dazhong (2005) analyzed the location distribution and regional specialization of China's service industry and its sub-sectors based on LQ index, RCA index and K-spec index, and believed that the difference in this specialization is not only due to the "non-trade" of the service itself, but also to the difference in the specialization and division of labor of various service sectors.

The vigorous development of the digital economy has brought great changes to the social economy, production and lifestyle, and the research on the development of the digital economy has become the focus of many scholars at home and abroad. The digital economy is a series of economic activities with data as the main factor of production and new technologies such as information communication and artificial intelligence as the effective carrier. Bai Xuejie et al. (2022) concluded that the development of the digital economy has significantly promoted the development of the industrial structure in the direction of service, and at the same time promoted the upgrading of the industrial structure and the service industry structure. Han Jian et al. (2022) found that the development of the digital economy is conducive to the upgrading and rationalization of the industrial structure, and can have a positive impact on the transformation and upgrading of the industrial structure by stimulating urban R&D and innovation. Wang Yifei et al. (2022) found that the digital economy promotes the upgrading of the industrial structure, but has a negative effect on the rationalization of the industrial structure. Cao Yuping (2020) found that the popularization of the Internet in the era of digital economy has promoted the agglomeration of China's spatial economy, and this role has increased with the improvement of innovation level.

Based on the relevant literature at home and abroad, it can be found that there are abundant relevant studies in the academic circles on both the agglomeration of producer services and the digital transformation of enterprises, but few studies link the interaction mechanism between the agglomeration of producer services and the digital transformation of enterprises. Scholars pay more attention to the research on the respective fields of producer service agglomeration and enterprise digital transformation, that is, there is still a lack of direct evidence on the interaction mechanism between producer service agglomeration and enterprise digital transformation. This paper intends to use a combination of qualitative and quantitative analysis to explore the mechanism of producer service industry agglomeration and enterprise digital transformation, in order to deepen the existing research perspective to a certain extent.

3. The Current Situation and Problems of The Agglomeration of Producer Services

3.1. The scale of development of producer services

Producer services play an important role in the economy and society, and are a new driving force for the high-quality development of China's economy. In recent years, China's producer service industry has developed rapidly, and its proportion of observed value in the economic structure has been rising. In 2019, the added value of the national producer service industry

reached 207381 billion yuan, accounting for 21.0% of the national GDP, and the added value increased by 15,381 billion yuan compared with 2009. Among them, the urban agglomeration in the middle reaches of the Yangtze River, as an important "growth pole" for China's high-quality development and an important supporting force for the development of the Yangtze River Economic Belt and the rise of central China, has been extremely dynamic in the development of its producer service industry in recent years, and the number of employees has been growing. As shown in Table 1, the number of employees in the producer service industry in the urban agglomeration in the middle reaches of the Yangtze River reached 2,140,400 in 2019, an increase of 1,029,600 over 2003.

From 2003 to 2019, the scale of transportation, information software, finance, leasing and business services, and scientific research and technical services in the middle reaches of the Yangtze River urban agglomeration showed an overall growth trend. By 2019, the number of employees in the financial industry reached 602,100, which has replaced the transportation industry as the largest producer service industry in the urban agglomeration in the middle reaches of the Yangtze River, the information software industry, leasing and business services have the strongest growth trend, with 258,800 employees and 413,700 employees, respectively, the growth trend of the transportation industry is relatively slow, with 519,300 employees, and the number of employees in scientific research and technical services is 346,500, with an average annual growth trend.

Table 1 Number of employees in producer services and sub-sectors in the urban agglomeration in the middle reaches of the Yangtze River (unit: 10,000 people)

year	Producer services	Transportation industry	Information software industry	Finance	Lease and Business services	scientific research and technical services
2003	111.084	43.33	8.29	27.53	13.75	18.18
2004	109.94	41.18	8.51	28.02	14.05	18.18
2005	113.11	45.84	9.42	27.43	12.85	17.57
2006	117.35	48.25	11.02	27.70	12.20	18.18
2007	111.31	45.99	9.45	25.89	111.76	18.22
2008	121.21	47.69	9.96	30.93	14.23	18.40
2009	126.46	46.44	11.22	34.65	14.49	19.66
2010	129.87	46.53	11.82	35.79	15.02	20.71
2011	135.43	47.74	12.63	37.07	16.29	21.70
2012	141.09	46.68	14.47	38.29	17.32	24.33
2013	159.99	53.19	17.23	40.46	21.01	28.10
2014	161.96	50.02	18.46	41.40	22.07	30.01
2015	167.20	51.37	18.24	43.70	24.16	29.73
2016	172.59	51.54	18.86	46.25	24.94	31.00
2017	181.54	53.31	20.43	47.38	29.96	30.47
2018	185.84	50.92	24.29	48.55	31.38	30.69
2019	214.04	51.93	25.88	60.21	41.37	34.65

3.2. Measurement of the agglomeration level of producer services

Producer services play an important role in the economy and society, and are a new driving force for the high-quality development of China's economy. In recent years, China's producer

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3.3. Problem analysis

3.3.1. Insufficient industrial synergy

The industrial isomorphism between cities in the urban agglomeration in the middle reaches of the Yangtze River is relatively serious, and the coordination and cooperation mechanism between various industries of producer service industry and manufacturing industry has not been effectively established. When competing for resources and market share, cities often ignore the overall interests of the region, resulting in an unreasonable industrial division of labor, and the upstream and downstream links of the industrial chain are not closely connected, making it difficult to form an industrial pattern of complementary advantages and coordinated development. Especially in the field of financial services, the business competition between financial institutions in various cities is fierce, but cross-regional financial cooperation and innovation are relatively lagging behind, and the flow of financial resources in the region is not smooth, which cannot fully meet the diversified financial needs of enterprises in the region.

3.3.2. Limited innovation capacity

Although there are many universities and scientific research institutions in the urban agglomeration in the middle reaches of the Yangtze River, the conversion rate of scientific research achievements is low, and the innovation ability of producer service enterprises is insufficient. On the one hand, the industry-university-research cooperation mechanism is not perfect, the scientific research achievements of universities and scientific research institutions are out of touch with the actual needs of enterprises, and there is a lack of effective transformation platforms and channels, resulting in a large number of idle and wasteful scientific research achievements. On the other hand, producer service enterprises generally have problems such as insufficient R&D investment and shortage of innovative talents, which make it difficult to carry out technological innovation and service model innovation activities with independent intellectual property rights, which restricts the innovation-driven development of industrial agglomeration. Especially in the field of information technology services, although some enterprises have a certain foundation in software development, they are relatively lagging behind in the application and innovation of emerging technologies such

as big data, cloud computing, and artificial intelligence, and it is difficult to meet the market demand for high-end information technology services.

3.3.3. Unbalanced regional development

There are obvious regional differences in the development of producer service industry agglomeration in the urban agglomeration in the middle reaches of the Yangtze River. Wuhan, Changsha, Nanchang and other central cities have a high level of development of producer services and significant agglomeration effects, while the development of producer services in surrounding small and medium-sized cities is relatively lagging behind and the degree of industrial agglomeration is low. This imbalance in regional development leads to the unreasonable allocation of resources in the region, and the central city faces problems such as excessive pressure on resources and environment and limited development space, while the surrounding cities are difficult to fully enjoy the economic radiation effect brought by industrial agglomeration, which restricts the overall coordinated development of urban agglomeration. In the field of logistics services, Wuhan, Jiujiang and other transportation hub cities have perfect logistics infrastructure and high concentration of logistics enterprises, while some inland small and medium-sized cities have imperfect logistics distribution networks and low logistics efficiency, which has affected the process of regional logistics integration.

3.3.4. Shortage of high-end talents

The producer service industry is a knowledge-intensive industry with a strong demand for high-end talents. The urban agglomeration in the middle reaches of the Yangtze River faces many challenges in attracting and retaining high-end talent. On the one hand, compared with the developed regions in the east, there is a certain gap in terms of salary, career development opportunities, living environment, etc., which makes it difficult to attract top talents at home and abroad. On the other hand, there is a structural contradiction between the talents cultivated by universities and vocational education institutions in the region and the actual demand of the producer service industry, and the shortage of professional and skilled talents and compound talents restricts the talent support capacity of industrial agglomeration. For example, in the field of scientific and technological research and development services, the lack of high-end scientific research talents and innovation teams has led to the slow progress of some key technology research and development, which has affected the technological innovation ability and market competitiveness of enterprises.

4. The Current Situation and Problems of Enterprise Digital Transformation

4.1. Development status of enterprise digital transformation

4.1.1. Technology application is widely penetrated

First, a large number of enterprises have migrated some or all of their business systems to the cloud to enjoy the advantages of cloud computing, such as elastic expansion, cost-effectiveness and convenient management. For example, many small and medium-sized enterprises use cloud storage and cloud office software to achieve collaborative editing of documents, data backup, and office access anytime, anywhere, improving work efficiency and reducing IT infrastructure investment costs. Second, enterprises are paying more and more attention to the mining and utilization of data assets, and using big data analysis technology to gain a deeper understanding of customer needs, market trends, and operational conditions. E-commerce companies such as Amazon use massive user purchase behavior data to make accurate recommendations, which significantly improves the sales conversion rate. Manufacturing enterprises use big data to analyze quality data in the production process to achieve accurate control of product quality and fault predictive maintenance, and reduce scrap rate and

production costs. Third, it plays an important role in many fields such as customer service, manufacturing, and supply chain management. The intelligent customer service system can automatically answer customer frequently questions, quickly respond to customer inquiries, and improve customer satisfaction; On the production line, artificial intelligence algorithms can optimize production scheduling, adjust equipment parameters based on real-time data, and improve production efficiency and product quality consistency. In supply chain management, machine learning models can predict fluctuations in demand, optimize inventory levels, and reduce the risk of overstocking and stockouts.

4.1.2. Differences in industry coverage and enterprise size

First, the pace and focus of digital transformation vary across industries. Due to its high dependence on data processing and transaction efficiency, the digital transformation of the financial industry started earlier and deepened, and digital financial services such as online payment, mobile banking, and robo-advisors have been widely popularized. The manufacturing industry is actively promoting intelligent manufacturing, and realizing the automation, intelligence and flexibility of the production process through digital technology; In the service sector, such as retail, catering, and tourism, digital transformation mainly focuses on online sales channel expansion, customer relationship management optimization, and digital marketing promotion to improve customer experience and operational efficiency. Second, large enterprises usually have stronger resource investment capabilities and strategic planning capabilities in digital transformation, and can carry out large-scale digital project construction, such as multinational companies building a globally integrated digital supply chain system and digital marketing platform, leading the trend of digital development in the industry. However, the digital transformation of small and medium-sized enterprises (SMEs) is also showing a positive trend, and some SMEs can quickly realize the digital transformation of business processes and enhance their competitiveness with the help of low-cost digital solutions such as cloud services and SaaS platforms. For example, some small e-commerce companies have made good progress in market segments by using the store management tools and data analysis functions provided by e-commerce platforms to accurately locate target customers, optimize product display and marketing strategies.

4.1.3. Business model innovation and digital ecosystem construction

First, digital transformation has prompted companies to explore new business models. The sharing economy model breaks the traditional concept of ownership, and realizes the efficient allocation and utilization of resources through the sharing platform, such as the rise of business models such as bicycle sharing and shared office space; The platform economy model is also booming in many industries, and enterprises have created a new value network by building digital platforms to connect supply and demand, such as e-commerce platforms, social platforms, travel platforms, etc., which not only change the traditional way of trading, but also derive a series of value-added services and profit models, such as advertising, transaction commissions, data services, etc. Second, enterprises realize that it is difficult to achieve sustainable development in the digital era, and they have strengthened digital collaboration with partners to build digital ecosystems. For example, tech giants such as Apple have built an iOS ecosystem that integrates hardware manufacturers, software developers, content providers, and other resources to provide users with a rich and diverse product and service experience. Traditional manufacturing enterprises are also actively establishing digital partnerships with suppliers, distributors, and scientific research institutions to jointly carry out R&D innovation, supply chain optimization, and market expansion activities to achieve resource sharing, complementary advantages, and risk sharing.

4.2. Problems faced by enterprises in digital transformation

4.2.1. Insufficient strategic planning and top-level design

Many enterprises lack a clear plan for the goals and paths of digital transformation, and fail to closely integrate digital transformation with the long-term strategic vision of the enterprise, resulting in blind follow-up in the transformation process, scattered investment, and difficulty in forming synergies and core competitiveness. Digital transformation involves all levels and business links of enterprises, and needs to be planned and coordinated from a strategic perspective. However, in the process of transformation, some enterprises lack a unified top-level design, each department works independently, the phenomenon of data silos is serious, and there is a lack of effective connection and collaboration between business processes, which cannot achieve the overall optimization and systematic improvement of digital transformation.

4.2.2. Data management and data security challenges

Enterprises have accumulated a large amount of data in the process of digital transformation, but the data quality is uneven, and there are problems such as inaccurate, incomplete, and inconsistent data. This is mainly due to the variety of data collection channels, inconsistent data standards, and untimely data updates. Low-quality data will affect the accuracy of data analysis and the scientificity of decision-making, leading enterprises to make wrong judgments and decisions in market competition. As the value of data assets becomes more prominent, so do the data security risks faced by enterprises. Security incidents such as data breaches, cyber attacks, and malware infections occur frequently, causing huge reputational and economic losses to enterprises. Enterprises have many weaknesses in data security management, such as backward security protection technology, weak employee security awareness, and lax data access management, which make it difficult to effectively deal with increasingly complex data security threats.

4.2.3. Shortage of technical capacity and talents

Digital transformation involves the application and integration of a variety of advanced technologies, such as cloud computing, big data, artificial intelligence, and the Internet of Things, and the complexity and rapid development of these technologies have brought huge technical challenges to enterprises. Enterprises need to have cross-domain technology integration capabilities and expertise to achieve seamless docking and collaboration between different technology systems. However, most enterprises are relatively weak in terms of technology R&D and application capabilities, and it is difficult to build and maintain complex digital technology platforms independently, and they often need to rely on the support of external technology vendors, which increases the cost and risk of transformation to a certain extent. In addition, digital transformation requires a workforce with digital literacy and professional skills. However, the current market is in short supply of such compound digital talents, and enterprises are facing great difficulties in talent recruitment and training.

5. Suggestions

Based on the foregoing, this paper puts forward the following three suggestions: First, the government should formulate and improve relevant policies to encourage the agglomeration of producer services and the digital transformation of enterprises. For example, tax incentives and financial subsidies have been introduced to support the digital transformation and innovative development of producer service enterprises; Set up an industry guidance fund to guide social capital to invest in producer service industry agglomeration areas and digital transformation projects. Second, establish and improve the talent training system, strengthen the relevant professional settings of universities and vocational colleges, and cultivate compound talents who can adapt to digital transformation. At the same time, preferential policies will be

formulated to attract outstanding digital talents and innovative teams at home and abroad, so as to provide talent support for the agglomeration of producer services and the digital transformation of enterprises. Third, enterprises should fully recognize the importance and urgency of digital transformation, strengthen cooperation with producer service enterprises, and make full use of the resource advantages brought by the agglomeration of producer services to jointly carry out digital projects to achieve mutual benefit and win-win results. For example, manufacturing enterprises can cooperate with R&D and design companies to carry out digital design and innovation of products; Cooperate with information technology service enterprises to improve the informatization level and digital operation capabilities of enterprises.

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