Original Paper

Study on the Path of Foreign Trade Development of Manufacturing Industry in Chengdu-Chongqing Area Empowered by Digital Economy

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Abstract

This paper focuses on the enabling path of the digital economy for the development of manufacturing foreign trade in the twin-city economic circle of Chengdu-Chongqing region. Through in-depth analysis of the current situation, opportunities and challenges of the digital development of manufacturing foreign trade in Chengdu-Chongqing region, it explores the role of digital economy empowering the development of manufacturing foreign trade mechanism, including the technology empowerment path, collaborative innovation mechanism and policy support system, and ultimately puts forward the optimization of the path of the digital economy empowering the development of manufacturing foreign trade in Chengdu-Chongqing region. The results of the study show that digital technology plays a key role in improving production efficiency, optimizing trade patterns, and expanding international markets; the collaborative innovation mechanism promotes the circulation of data elements and the digital synergy of the industrial chain; and the policy support system provides a guarantee for the digital transformation of manufacturing foreign trade. The study is of great significance for Chengdu-Chongqing region to enhance the status of global digital trade and promote the high-quality development of China's manufacturing foreign trade.

Keywords

Digital Economy, Chengdu-Chongqing Region, Manufacturing Industry, Foreign Trade Development

1. Introduction

The construction of digital strong trade is an important part of the construction of China's trade power, an important initiative to realize the high-quality development of China's trade, and a new engine for realizing a high level of opening up to the outside world. The report of the 20th Party Congress emphasizes that "accelerate the development of the digital economy, promote the deep integration of the digital economy and the real economy, and create internationally competitive digital industry

clusters." The digital economy is becoming a key force in reorganizing global factor resources, reshaping the global economic structure, and changing the pattern of global competition. Under the influence of internal and external changes such as the weakening of the comparative advantage of traditional foreign trade and the escalation of trade friction between China and the United States, it is particularly important to accelerate the digital technology-enabled enhancement of the digitalization capacity of foreign trade, and to shape the new kinetic energy for the high-quality development of foreign trade.

The twin-city economic circle of Chengdu-Chongqing region occupies an important position in China's economic map, with its strong manufacturing base, which is a key growth pole for China's manufacturing foreign trade (Chen et al., 2022). However, under the current complex and changing international economic situation, manufacturing foreign trade in Chengdu-Chongqing region faces many challenges. The study of Xu et al. (2025) shows that the trade openness of Chengdu-Chongqing Twin Cities Economic Circle is lower than the national average and other three regional city clusters, and the trade cost remains high. At the same time, the traditional trade model has insufficient growth momentum, the international market competition is getting more and more intense, and the digital transformation process of enterprises in the region is uneven (Huang et al., 2024), which seriously constrain the further development of manufacturing foreign trade in Chengdu-Chongqing region.

Driven by the wave of global digitization, the digital economy has become the core force driving the economic growth of all countries and reshaping the pattern of international trade (Jing & Sun, 2019; Li et al., 2024). The digital economy takes digitized knowledge and information as the key elements, relies on modern information networks, and drives economic activities with the help of information and communication technology (Jing & Sun, 2019). Its innovative, integrated and highly permeable characteristics enable it to deeply integrate with traditional industries and promote industrial upgrading (Ding, 2020), which in turn has a profound impact on economic growth and international trade. Numerous studies have shown that the digital economy has a significant role in promoting high-quality development and technological innovation (Song, 2020; Zhao et al., 2022; OECD, 2021), and has also changed the pattern and pattern of international trade (Li et al., 2023; UNCTAD, 2022).

China has actively adhered to the trend of digital economy development and vigorously promoted the integration and development of digital economy and real economy. In this context, Chengdu-Chongqing region, with its good foundation and development potential in the field of digital economy, has become the pioneer area of digital economy in western China and a new growth pole for the development of the national digital economy industry. The state and local governments have successively issued a series of policies to provide strong support for the digital transformation of the manufacturing industry in Chengdu-Chongqing region. For example, in November 2021, the Ministry of Commerce issued the "14th Five-Year Plan" for the high-quality development of foreign trade, which emphasizes the improvement of trade digitization and the promotion of digital trade projects; in January 2022, the State Council issued the "14th Five-Year Plan" for the development of the digital economy, which explicitly proposes to accelerate trade digitization and promote the development of the digital economy industry. The "14th Five-Year Plan for the Development of Digital Economy" issued by the State Council in January 2022 explicitly proposes to accelerate the development of trade digitization; the "Outline for the Construction of Chengdu-Chongqing Twin-city Economic Circle" (2021) also actively advocates the vigorous development of the digital economy, promotes the in-depth

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fusion of information technology and the real economy, and accelerates the development of digitization in key areas.

From the perspective of theoretical research, the current research on the development of manufacturing foreign trade in the Chengdu-Chongqing region empowered by the digital economy is still in the exploratory stage (Chen et al., 2024; Huang et al., 2024). Existing research focuses on the impact of digital economy on overall foreign trade, and there are relatively few specialized studies on manufacturing foreign trade in Chengdu-Chongqing region, and there are still deficiencies in the depth and breadth of the application of digital technology, and the improvement of the collaborative innovation mechanism. From a practical point of view, in-depth investigation of the mechanism and path of the digital economy to empower the development of manufacturing foreign trade in the Chengdu-Chongqing region, to promote the high-quality development of manufacturing foreign trade in the Chengdu-Chongqing region is of great practical significance. Not only can it help Chengdu-Chongqing region take advantage of the digital economy, strengthen digital trade cooperation with countries along the "Belt and Road", enhance its position in the global digital trade pattern, and create an important node of the "Digital Silk Road" (Xiang, 2017; Liang & Qin, 2024), and can also provide valuable experience for the digital development of foreign trade in manufacturing industries in other inland regions.

2. Chengdu-Chongqing Region Manufacturing Foreign Trade Digital Development Status Quo

2.1 Analysis of the Industrial Base

The automobile and electronic information industries in Chengdu-Chongqing, as leading manufacturing industries, have performed well in the export field. Take the automobile industry as an example, the export scale increases year by year, new energy vehicles become a new engine of growth, products from traditional fuel vehicles to intelligent, electrified transformation. 2024, Chongqing automobile production reached 2.54 million units, an increase of 9.4% year-on-year; the export performance is also bright, in 2024, Chongqing exported 477,000 units of automobiles, an increase of 29.6% year-on-year, with the value of 43.11 billion yuan, up 30% year-on-year. The export performance is also impressive. In addition to Antarctica, "Chongqing cars" can be seen on all six continents. The key to such excellent results lies in the strong rise of high-end new energy smart models. Take Chongqing car company SERES as an example, SERES new energy vehicles have covered 62 countries, with more than 300 dealers, cumulative exports of more than 500,000 units. At present, Chongqing has gathered 19 vehicle enterprises, with an annual production capacity of nearly 4 million vehicles, with 1,200 parts and components enterprises above designated size, automobile production accounted for 8.1% of the country, automobile exports accounted for 7.4% of the country, the automobile industry of the city and the surrounding areas of the economy to promote the role of the city. At present, Sichuan and Chongqing are actively implementing the Chengdu-Chongqing region of the twin-city economic circle construction of the national strategy to strengthen the automobile industry collaboration with intelligent network and new energy as the main direction of attack to build a high level of automobile R & D and manufacturing bases, and actively strive for the creation of the national advanced manufacturing clusters. Chongqing "Chongqing International Trade Digital Platform" plays a key role in this process, through the integration of trade data, help automotive enterprises accurately docking international market demand, expanding the "Belt and Road" along the countries and other emerging markets, in the global automotive industry chain. With the advantages of industrial clusters

and cost control, it has gained a firm foothold in the global automotive industry chain. However, in the era of digital economy, the trend of software-defined automobile is highlighted, and the degree of mastery of the core technology of intelligent networked automobile has become a challenge for the further development of the industry. In terms of the core technology of intelligent networked vehicles, compared with international head automobile enterprises, the number of patents in Chengdu-Chongqing area accounts for only 30%, and there is much room for improvement.

As another leading industry in Chengdu-Chongqing region, electronic information industry has a huge export scale. According to Chengdu Customs statistics, in the first two months of 2025, Sichuan exported 80.54 billion yuan of electromechanical products, a year-on-year increase of 17.2%, accounting for 78.1% of the total value of Sichuan's exports in the same period, of which integrated circuits, laptops, tablet PC exports increased by 38.1%, 47.7%, 23.2% year-on-year growth, the tablet PC export scale to maintain the first in the country. Chengdu-Chongqing area around integrated circuits, new display, intelligent terminals and other accelerated complementary strong chain, has become the world's top ten electronic information manufacturing industry gathering place. Through the Chengdu "China-European liner + digital customs clearance" mode, electronic information products significantly shorten the transportation time, reduce transportation costs by about 20% -30%, and vigorously promote the products to the international market. However, in the high-end chip R & D and other core technologies, Chengdu-Chongqing area enterprises R & D investment accounted for an average of 5% of sales revenue, far lower than the international leading enterprises 15%-20% level. In the digital economy wave, IC advanced process technology, high-end chip R & D and other core technology shortcomings, as well as international trade friction triggered by the supply chain risk, restricting the industry's continued expansion.

In addition, in terms of digital infrastructure, Chengdu-Chongqing area has achieved fruitful results in the construction of industrial Internet platforms, with many national and provincial key platforms emerging, the number of connected enterprises increasing, and the rate of industrial equipment going to the cloud rising steadily, which builds a firm foundation for the digital transformation of manufacturing enterprises. 5G network coverage continues to expand, with the core areas of cities and industrial parks basically realizing in-depth coverage, and is widely used in the fields of industrial manufacturing, intelligent logistics and other areas. It is widely used in industrial manufacturing, intelligent logistics and other fields, giving rise to remote control, real-time monitoring and other digital application scenarios. Relying on these digital infrastructures, Chongqing's "Chongqing International Trade Digital Platform" deeply integrates data from multiple sources such as customs, tax, and logistics, optimizes the customs clearance process, and helps enterprises significantly shorten the time for customs clearance, significantly reduce costs, and vigorously promote the digital transformation of the manufacturing industry's foreign trade.

Table 1 and Table 2 shows that Sichuan and Chongqing actively respond to the "14th Five-Year Plan", on top of the original basis to continue to strengthen the assumptions of the digital economy construction and capital investment, is committed to the full implementation of the "Chengdu-Chongqing Twin Cities Economic Circle Construction Plan".

Table 1. Development Goals of Sichuan's New Infrastructure Construction in the 14th Five-Year Plan

Form	Norm	2020	2025
Information Infrastructure	Number of 5G base stations (10,000)	3.6	25
	5G end-user penetration rate (%)	11	60
	Data center rack size (10,000 racks)	10.5	50
	Base arithmetic level (trillions of times per second, PFlop/s)	---	500
	Industrial Internet industry nodes	---	10
Convergence Infrastructure	Number of devices connected (10,000)	---	2000
	Vehicle-Road Collaboration Demonstration Routes (kilometers)	10	340
	New energy vehicle charging piles (10,000)	---	25
	Typical application scenarios (cases)	---	50
Innovative Infrastructure	Major national scientific and technological infrastructure	7	9
	National research platforms	4	6
	Frontier-leading innovation platforms	2	6
	Industrial (technology, manufacturing) innovation centers	14	30

Table 2. Development Targets of Chongqing's Digital Economy in the 14th Five-Year Plan

Form	Norm	2020	2025
Digital Industrialization	Value added of core industries of the digital economy as a share of GDP (%)	7.3	>10
	Operating income from software and information services (billions of dollars)	2000	5000
Industrial Digitization	Numerical control rate of key processes of enterprises on a regular basis (%)	55	65
	Number of digital workshops and smart factories	426	[550]
	Industrial Internet logo registrations (billion)	1.04	15
	E-commerce transactions (billions of dollars)	12383	21000
	Smart Agriculture Demonstration Sites for Advantageous Specialty Industries	120	200
Digitization of Governance	Rate of "full network access" for government service matters (%)	84	95
	Openness ratio of public information resources (%)	20	40
	Municipal Smart Campus Construction Demonstration Schools	350	600
	Number of municipal smart hospitals	44	100
	Authorized Doctoral and Master's Degree Sites Related to the Digital Economy	/	[20]
Information Infrastructure	Scale of 5G base stations (10,000)	4.9	15
	Gigabit broadband subscribers (10,000)	4.5	42

Form	Norm	2020	2025
	10G-PON and above port size (10,000 ports)	2.7	40
	Number of standard racks in data centers (10,000)	11.9	50

Remarks: 1. The value in [ ] indicates the number of new additions in the planning period; 2. The number of standard racks in the data center is the number of racks constructed in Chongqing according to its own development needs, excluding the number of racks carrying the arithmetic needs of East-West Computing and so on.

2.2 Status of Technology Application and Innovation

In the Chengdu-Chongqing manufacturing industry, the application of artificial intelligence and big data analytics technology presents a "polarization" phenomenon. On the one hand, the head of the enterprise has deeply integrated these technologies in the whole process of production and operation. At the market insight level, with the help of massive market transaction data, consumer behavior data and industry dynamic data, enterprises can accurately grasp the market trend. In the field of electronic information products, for example, through the deep mining of global consumer market data, we can predict in advance the trend of functional diversification and fashionable appearance of smart wearable devices, and adjust the direction of product development in a timely manner. In manufacturing, the integration of big data and artificial intelligence technology significantly improves production efficiency and product quality. Take automobile manufacturing as an example, the real-time collection and analysis of equipment operation data and process parameter data on the production line, the use of artificial intelligence algorithms to build quality prediction models, and identify in advance the production links that may have quality problems. According to relevant data, some automobile manufacturing enterprises in Chengdu-Chongqing region that have implemented intelligent transformation have reduced the defective rate by 15%-20% and increased production efficiency by 20%-25%. In terms of supply chain management, the intelligent inventory management system based on big data analysis, based on market demand forecasts, supplier delivery cycle and other data, dynamic adjustment of raw material inventory levels. Data from the Chongqing Municipal Commission of Economy and Information Technology show that the output value of the city's enterprises implementing intelligent transformation accounted for 58.6% of the city's output value, with a growth rate 3.1 percentage points higher than that of the city, and contributing to the growth rate of the city's industrial output value by more than 70%.

On the other hand, small and medium-sized manufacturing enterprises still face multiple challenges in the application of these technologies. Lack of technical talents is the first challenge, and many enterprises have indicated that they lack professional technical talents, which makes them unable to effectively implement and maintain the relevant technical systems. According to statistics from the Sichuan Provincial Department of Economy and Information Technology, the shortage of technical talents has become one of the key constraints to the digital transformation of SMEs in Sichuan Province. High investment costs also constrain the application of technology in SMEs, the purchase of advanced hardware and software equipment and long-term operation and maintenance costs beyond the affordability of most SMEs. Insufficient data accumulation is also prominent, many enterprises have not yet established a perfect data collection and storage system, data integrity and accuracy is difficult to guarantee, so that the reliability of data analysis greatly reduced, can not be a powerful support for business decision-making. In addition, some enterprises lack a clear understanding of how to combine

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technology with their own business, and there is confusion in the exploration of the path of technology application. A survey of 300 small and medium-sized manufacturing enterprises in the Chengdu-Chongqing region shows that only 18% of enterprises have the ability to carry out big data analysis, and 12% of enterprises have applied AI technology. To address these issues, the governments of Chongqing and Chengdu have launched SME digital transformation subsidy policies and technical service platforms, but the coverage and practical effects still need to be improved.

In the Chengdu-Chongqing area, large manufacturing enterprises in the digital design and simulation technology application has reached a high level, a strong impetus to product innovation and production efficiency. In the automobile manufacturing industry, many large automobile manufacturing enterprises have fully adopted digital design and simulation technology, build a set of computer-aided design (CAD), computer-aided engineering (CAE), computer-aided manufacturing (CAM) and product lifecycle management (PLM) in one integrated platform. Through the platform, the realization of the conceptual design of products from the production of manufacturing the whole process of digital collaborative operations, significantly shorten the new product development cycle. Relevant data show that some large automobile manufacturing enterprises with the help of digital technology, R & D cycle from the original 3-5 years shortened to 1.5-2.5 years, R & D costs reduced by 30%-40%. In the research and development of automobile collision safety performance, enterprises use high-precision numerical simulation technology to conduct a large number of virtual collision tests, the number of virtual tests accounted for more than 80% of the total number of tests, not only to reduce the number of physical prototype tests, reduce costs, but also through the simulation results of in-depth analysis and optimization, significantly improve the safety performance of automotive products.

The electronic information manufacturing sector has also actively embraced digital design technology. In terms of integrated circuit design, large-scale electronic information enterprises in the Chengdu-Chongqing area have generally adopted advanced electronic design automation (EDA) tools to realize a high degree of automation and intelligence in chip design. Through the chip circuit performance, power consumption, thermal characteristics and other multi-physical field accurate simulation, the chip first chip success rate from the past less than 30% to 60% -70%, R & D efficiency increased by 40% -50%. With the help of cloud-based collaborative design platform, enterprises can break the geographical limitation and realize real-time collaboration of design teams around the world.

In contrast, small and medium-sized enterprises (SMEs) in the traditional manufacturing sector in the Chengdu-Chongqing area are seriously lagging behind in the popularization of digital design and simulation technologies. In equipment manufacturing, furniture manufacturing and other traditional manufacturing SMEs, digital R & D and design tools penetration rate is low, the key process CNC rate is not high. According to the statistics of the Department of Economy and Information Technology of Sichuan Province, the popularization rate of digital R & D and design tools among traditional manufacturing SMEs in Sichuan Province is less than 40%, and the rate of numerical control of key processes is only about 30%. The reasons for this phenomenon are manifold. First, the accumulation of technology is weak, many SMEs rely on traditional design methods and manufacturing processes for a long time, lack of understanding of digital design technology and experience in the application of digital transformation to face a number of technical difficulties. Secondly, the shortage of professionals is prominent, skilled mastery of modern CAD/CAE tools, designers and engineers are scarce, the enterprise is difficult to set up an effective digital design team. Furthermore, the high acquisition cost of genuine design software and maintenance costs for small and medium-sized enterprises. In addition,

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part of the enterprise management on the digital design technology return on investment there are doubts, that it is difficult to see the obvious benefits in the short term, the digital design input enthusiasm is not high.

2.3 Status of the Policy Environment

In terms of local government digitalization support policies, the governments of Chengdu and Chongqing have actively introduced digitalization support policies to promote the digital development of manufacturing foreign trade. Chongqing Municipality has set up a special industrial fund to support enterprise digital transformation projects, and give financial incentives to enterprises with outstanding performance in the construction of industrial Internet platforms and the application of digital technology research and development. Chengdu City, on the other hand, launched tax incentives to carry out digital transformation of manufacturing enterprises to reduce or waive part of the tax. However, in the process of implementing the policy, there are problems such as cumbersome declaration process and long audit cycle, which affect the enthusiasm of some enterprises to enjoy the policy dividends.

In terms of international cooperation, Chengdu-Chongqing region has actively responded to the national "Belt and Road" initiative and strengthened economic and trade cooperation with countries along the route. By organizing activities such as the International Industrial Cooperation Forum, it has built a platform for manufacturing enterprises to communicate with the outside world. At the same time, the government encourages enterprises to set up R & D centers and production bases overseas, and provides facilitation policies in foreign exchange management and approval of overseas investment. However, in practice, enterprises investing overseas face risks such as cultural differences and different policies and regulations, and the existing policies are not yet sufficiently supportive in terms of risk early warning and response guidance.

3. Mechanisms for Enabling Foreign Trade Development in the Digital Economy

3.1 Technology Enabling Path

In the manufacturing production chain, the application of big data, artificial intelligence, Internet of Things and other digital technologies is reshaping the production model. Chongqing, an automotive manufacturing enterprises to introduce industrial Internet of Things technology to achieve the interconnection of production equipment, real-time collection of equipment operation data, production process parameters. Through big data analysis, the enterprise can accurately grasp the production situation, timely detection and resolution of potential problems, product defective rate reduced by 10% -15%. Artificial intelligence technology plays an important role in quality inspection, using image recognition, machine learning algorithms, high-precision detection of products, improve detection efficiency and accuracy. At the same time, digital technology promotes the intelligence of the production process, automated production and flexible manufacturing, enterprises can quickly adjust the production plan according to market demand, production efficiency increased by 20%-30%, effectively enhancing the competitiveness of products in the international market.

Cross-border e-commerce platforms and digital trade platforms play an important role in the trade chain. Taking cross-border e-commerce enterprises in Chengdu-Chongqing region as an example, through e-commerce platforms, enterprises are able to directly face global consumers and expand customer resources. According to statistics, the cross-border e-commerce export value of Chengdu-Chongqing region will increase by more than 30% year-on-year in 2023. The digital platform

simplifies the transaction process, realizing online transactions, electronic contract signing, online payment and other functions, greatly shortening the transaction cycle. In terms of marketing, using big data to analyze consumer preferences and behavioral data, enterprises are able to carry out precise marketing, improve marketing effectiveness and reduce marketing costs. The platform also integrates logistics, finance and other services to provide one-stop solutions for enterprises, reducing transaction costs and improving trade efficiency.

3.2 Co-innovation Mechanisms

The synergistic innovation of Chengdu-Chongqing Twin Cities in the circulation of data elements has provided strong data support for the development of foreign trade in manufacturing. Although the cooperation mechanism is still in the process of being perfected, the development prospect is broad. With the deepening awareness of the importance of data between the two places, it is actively exploring the establishment of unified data rights standards and trading rules, which will effectively solve the problem of unclear data ownership and promote data trading and sharing. Cultivating the data trading market will enable data elements to be rationally allocated in accordance with the laws of the market and give full play to their maximum value. Strengthening data security protection and establishing a unified data security guarantee system can eliminate enterprises' concerns about data security and build a data security defense line for the collaborative development of manufacturing foreign trade. Through these initiatives, the flow of data elements in Chengdu-Chongqing Twin Cities will be smoother, providing strong data support for the development of manufacturing foreign trade.

The digital economy has strongly promoted collaborative innovation between enterprises upstream and downstream of the Chengdu-Chongqing manufacturing industry chain. Take the automobile industry chain as an example, Chongqing's vehicle manufacturing enterprises and Sichuan's parts suppliers work closely through the industrial Internet platform to realize information sharing and co-production. Vehicle enterprises formulate production plans based on market demand and pass them to parts suppliers in real time, and suppliers adjust production arrangements accordingly, realizing zero inventory management and reducing inventory costs. In terms of technology research and development, enterprises have strengthened cooperation and jointly tackled key technical problems of intelligent networked vehicles, which has improved the technical level and competitiveness of the whole industrial chain. Through digital synergy, upstream and downstream enterprises of the industry chain realize resource sharing and complementary advantages, optimize supply chain management, improve the overall efficiency and risk-resistant ability of the industry chain, and promote the Chengdu-Chongqing region's manufacturing industry in the global industry chain to climb the status.

3.3 Policy Support System

The State and the Chengdu-Chongqing region have introduced a series of policies to support the digital economy, manufacturing development and foreign trade promotion. The Outline of the Construction Plan for the Twin-City Economic Circle in the Chengdu-Chongqing Region puts forward the objectives of strengthening digital infrastructure construction and promoting the high-quality development of the manufacturing industry; Sichuan Province has issued the Implementation Opinions on Accelerating the High-Quality Development of the Digital Economy, which specifies the direction of the development of the digital economy and the key tasks; and Chongqing Municipality has issued the Three-Year Action Plan for Promoting the High-Quality Development of Foreign Trade in Chongqing Municipality (2022-2024), which is dedicated to enhancing the Chongqing Municipality issued the Chongqing Three-Year Action Plan for Promoting High-Quality Development of Foreign Trade (2022-2024),

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which is dedicated to improving the comprehensive strength of foreign trade. These policies provide support for the digital transformation of the manufacturing industry's foreign trade in terms of industrial layout, technological innovation and market expansion, and guide the concentration of resources in related areas.

Different policy tools play different roles in promoting the digital transformation of manufacturing enterprises, attracting digital economy talents and promoting the development of digital industries. Financial subsidies can directly provide enterprises with financial support for digital transformation projects such as technology research and development and equipment acquisition. Sichuan Province grants a certain percentage of subsidies to manufacturing enterprises that carry out digital transformation to stimulate the enthusiasm of enterprises. Tax incentives reduce the burden on enterprises, such as reducing or waiving corporate income tax and value-added tax for digital economy-related enterprises, encouraging enterprises to increase R & D investment. In terms of talent policies, Chengdu-Chongqing region attracts digital economy talents by providing housing subsidies, talent apartments, children's education and other preferential measures. However, there are some problems in the implementation of policy tools, such as the lack of precision in the distribution of financial subsidy funds, with some enterprises benefiting unevenly; the coverage of tax incentives needs to be expanded; and the attractiveness of talent policies needs to be further enhanced.

4. The Digital Economy Empowers Chengdu-Chongqing Region Manufacturing Foreign Trade Development Path Optimization

4.1 Strengthening the Technology Enablement Pathway

The Chengdu-Chongqing region needs to vigorously strengthen the independent innovation capability of the core technologies of the digital economy, and make key technological breakthroughs in the fields of industrial software, artificial intelligence algorithms, high-end chips and other areas a key task. It should actively promote the establishment of a joint laboratory for digital economy technology innovation, fully integrate the R & D strength of universities, research institutes and enterprises in Sichuan and Chongqing, form a strong innovation synergy, and jointly overcome the technical problems that constrain the development of digitalization of manufacturing foreign trade. At the same time, we will continue to increase investment in basic and applied research and devote ourselves to cultivating a number of digital technology achievements with independent intellectual property rights, so as to enhance the technological competitiveness of manufacturing foreign trade in the global market.

In addition, it is necessary to further deepen the integration and application of digital technology in the entire chain of manufacturing foreign trade. From R & D and design to production and manufacturing, to logistics and warehousing and marketing services, comprehensively promote the digital transformation of each link. Actively promote the innovative application of blockchain, big data, artificial intelligence and other cutting-edge technologies in the field of foreign trade, and carefully build a number of digital technology integration and application projects with demonstration effects. Encourage enterprises to make full use of advanced technologies such as digital twins and augmented reality to optimize the product design process, improve production efficiency, and speed up the development of new products, so as to respond to the demands of the international market more quickly and accurately, and enhance the comprehensive competitiveness of enterprises in the international market.

4.2 Improvement of Collaborative Innovation Mechanisms

In order to improve the mechanism of collaborative innovation, the Chengdu-Chongqing region should make efforts to establish a data-sharing platform, break down administrative barriers, and realize the free and efficient flow of data elements between the two regions. Formulate unified data grading and classification standards as well as open sharing rules, clarify data ownership and use boundaries, and ensure data security. Actively promote the data interconnection of customs, taxation, market supervision and other departments to provide convenient and comprehensive data services for manufacturing enterprises. At the same time, accelerate the construction of the Chengdu-Chongqing Industrial Big Data Center, widely converge multi-dimensional data on production, operation and management of industrial enterprises, and provide solid data support for the digital transformation of enterprises.

Building a collaborative innovation system for the manufacturing industry chain in the Chengdu-Chongqing region is crucial to promoting the collaborative development of upstream and downstream enterprises in the industry chain. Relying on the industrial Internet platform, it realizes the information interoperability and resource sharing of each link in the industrial chain, and then improves the efficiency of supply chain management. Give full play to the leading role of industry chain leading enterprises, encourage them to drive upstream and downstream small and medium-sized enterprises to carry out digital transformation, and create a good industrial ecology of digital cooperative development. Supporting the establishment of industry chain collaborative innovation alliance, organizing enterprises to jointly carry out key technology research and effectively enhance the overall competitiveness of the industry chain.

4.3 Optimizing the Policy Support System

The Chengdu-Chongqing region should work to improve the digital economy policy system and formulate special policies dedicated to the digital economy to empower manufacturing foreign trade. Strengthen the synergy between the policies of the two regions to avoid the problems of policy fragmentation and duplication, and form a strong policy synergy. Establish a scientific policy evaluation mechanism, conduct a comprehensive assessment of the effectiveness of policy implementation on a regular basis, and adjust and optimize policy measures in a timely manner based on the assessment results. Adhere to the problem-oriented, in-depth analysis of the pain points and difficulties in the development of the digitalization of manufacturing foreign trade, and the targeted introduction of support policies.

With regard to the policy implementation mechanism, innovation and optimization should be carried out in order to improve the effectiveness of policies on the ground. Simplify the policy declaration process, build a one-stop policy service platform, and provide enterprises with convenient policy consultation and declaration services. Improve the financial fund management system, improve the efficiency of fund utilization, and focus funds on digital technology R & D and application projects. Actively explore the establishment of a new mechanism for the training and introduction of digital economy talents, and increase support for high-end digital economy talents. Broaden investment and financing channels, encourage social capital to participate in the construction of digital economy, and build a diversified investment mechanism guided by the government and led by the market.

5. Conclusion

This paper systematically explores the core path of digital economy empowering the development of manufacturing foreign trade in Chengdu-Chongqing region, and reveals the key role of digital technology in reshaping industrial competitiveness and optimizing trade patterns. Relying on the export advantages of leading industries such as automobiles and electronic information, as well as the rapid layout of digital infrastructures such as industrial Internet platforms and 5G networks, Chengdu-Chongqing region has formed a solid foundation for the digital transformation of manufacturing foreign trade. However, the lack of independent innovation capacity of core technology, high barriers to digital application for SMEs, and the need to improve the efficiency of policy coordination still constrain the in-depth transformation of the region's manufacturing foreign trade.

The study found that the digital economy drives development through three mechanisms: technology, collaborative innovation and policy support: at the technology level, the application of big data, artificial intelligence and other technologies in manufacturing, supply chain management and precision marketing has significantly improved production efficiency and market responsiveness; at the level of collaborative innovation, the circulation of data elements and the digitalization of the industrial chain have effectively integrated regional resources and strengthened the competitiveness of industrial clusters; At the policy level, a series of national and local planning and support measures have provided institutional guarantee for the transformation, but the accuracy and effectiveness of the policies still need to be optimized.

In the face of global digital economy competition and domestic double cycle strategic opportunities, Chengdu-Chongqing region needs to focus on core technology research, deepen the integration of the whole chain of digital technology, build regional data sharing and industry chain synergistic system, and at the same time, strengthen the policy synergy and the implementation of innovation, in order to break through the bottleneck of the development of inland manufacturing foreign trade. This study not only enriches the theoretical exploration of the digital transformation of manufacturing foreign trade in inland areas, but also provides a practical path reference for Chengdu-Chongqing region to enhance its position in the global value chain and build an important node of the "Digital Silk Road", which is of great significance for promoting the high-quality development of manufacturing foreign trade in China.

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