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Study on the Path to Enhancing China's Industrial Chain Resilience

Meijing Song[1,2]

[1]School of Finance and Economics, Hainan Vocational University of Science and Technology, Haikou, Hainan, 570000, China
[2]School of Management, Universiti Sains Malaysia, Penang, 11800, Maylaysia
songmeijing@student.usm.my

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Abstract: With the rapid development of technologies such as big data, cloud computing, and artificial intelligence, the digital economy is transforming the operational models of traditional industries, providing new opportunities for the transformation, upgrading, and resilience enhancement of industrial chains. As the world's second-largest economy, China faces a complex and ever-changing domestic and international economic environment, where the stability and competitiveness of its industrial chains are directly linked to the sustainable and healthy development of its economy. To promote the modernization of industrial chains and improve their resilience, it is a key element and crucial step. The resilience of industrial chains is reflected in their ability to resist risks and recover, which requires systematic efforts such as filling gaps, extending chains, consolidating chains, and strengthening chains. However, at present, there are still challenges in enhancing China's industrial chain resilience, such as insufficient innovation capacity, a shortage of professional talent, and weak industrial foundations. Therefore, China should leverage the digital economy to accelerate the digital upgrade of its industrial chains, focus on breakthroughs in core technologies, and promote the development of more complete industrial chains, which is crucial for driving the high-quality development of China's industrial chains.

1. Explanation of Digital Economy

1.1 Definition of Digital Economy

The digital economy refers to an economic system that fundamentally changes the economic environment and activities through the widespread use of digital technologies. It is a new socio-political and economic system in which both information and business activities are digitalized. Transactions between enterprises, consumers, and governments conducted over the internet have rapidly increased. The digital economy primarily studies goods and services whose production, distribution, and sales rely on digital technologies. The business model of the digital economy operates well because it creates a win-win environment for both enterprises and consumers[1-3]. The development of the digital economy has had a significant impact on

management practices, including competitive strategies, organizational structures, and culture. As advanced network technologies are applied in practice, traditional notions of time and space have been truly challenged. Enterprises are striving to integrate their business with customers, suppliers, and partners in aspects such as data, information systems, workflows, and business practices, even though they each have different standards, protocols, needs, incentives, and workflows.

1.2 Background of Digital Economy Development

With the rapid development of information technology, the digital economy has gradually become a key driver of global economic growth. Under the leadership of cutting-edge technologies like big data, cloud computing, and artificial intelligence, the breadth and depth of the digital economy have expanded, changing the way people work and live. In terms of production methods, the digital economy enables automated and intelligent production processes, ensuring both production efficiency and product quality[4-5]. It fosters the emergence of new business forms and models, bringing new vitality to economic development. In terms of lifestyle, the digital economy facilitates people's lives, enriches their spiritual needs, and allows activities such as socializing and shopping through internet platforms, breaking the limitations of time and space, and enjoying the conveniences brought by the digital economy. In terms of governance, both government and enterprises should keep pace with the times, innovate governance concepts and methods based on demand, and adapt to the needs of the digital economy to achieve efficient governance and optimal results , as shown in Figure 1.

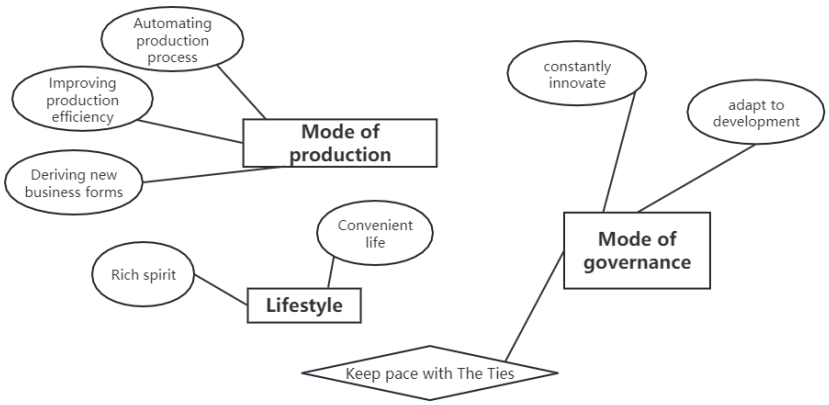

Figure 1: Changes brought about by the development of the digital economy

2. Mechanisms by Which the Digital Economy Affects Industrial Chain Resilience

2.1 Improving Supply Chain Operational Efficiency

A supply chain is a network of enterprises and departments engaged in production and processing, involving the flow of information, materials, funds, and technology. The formation of industrial chains relies on the input-output relationships between different industries in terms of technology, capital, and talent. To leverage the advantages of the digital economy, improving the operational efficiency of the supply chain can positively impact industrial chain resilience. With the rapid development of information technology, supply chains now require not just simple tracking, but real-time visualization to promote the development of supply chains. This allows for real-time monitoring of the flow of elements in the supply chain, making communication between enterprises smoother and more convenient, and mitigating external pressures to ensure smooth logistics[6-7]. In

the digital economy, data is a core production factor, and enterprises along the industrial chain can share and transmit various data, information, and instructions in real-time through digital communication tools, avoiding the time-space limitations and information loss inherent in traditional communication methods. This efficient communication and exchange enable upstream and downstream enterprises of the industrial chain to collaborate better, ensuring supply chain flexibility.

2.2 Enhancing the Stability of Enterprise Chains

Enterprises in an enterprise chain establish a network of relationships through cooperation. As a key component of the industrial chain, the stability of the enterprise chain has a profound impact on industrial chain resilience, ensuring the overall stability and sustainable development of the industrial chain. From the perspective of enterprise chains, the digital economy can strengthen the integration of data resources, innovative factors, and human capital, enhancing cooperation between enterprises and improving the stability of enterprise chains, which is significant for industrial chain resilience. Digital technologies such as cloud computing allow enterprises to quickly and cost-effectively share various data with partners in real-time, including marketing data, user behavior data, and operational data such as production, inventory, and logistics, improving collaboration efficiency and reducing operational costs[8-9]. Collaborative decision-making based on data sharing helps optimize resource allocation across the enterprise chain and enhances responsiveness. In addition, digital platforms can accelerate interaction between enterprises. Digital human resource management systems, for example, can unify talent information across enterprises, optimize talent matching, and cultivate targeted talent to improve the overall competitiveness of the industrial chain.

3. Issues in Enhancing China's Industrial Chain Resilience

3.1 Limited Innovation Capacity

Since the reform and opening-up, China’s digital innovation capabilities have significantly improved, and some fields are now at the forefront. However, many big data companies face the "plateau without peaks" problem, where their overall strength is strong, but they lack leading enterprises focused on core technologies. Traditional industries in China still face challenges in production technologies, equipment, product industrial structures, and specialization, resulting in weak independent innovation capacity in digital technologies, leading to excessive reliance on foreign imports of core technologies. Furthermore, due to systemic and mechanistic factors, market players have limited interaction and communication when applying digital technologies and sharing information, which reduces coordination and prevents optimal results. Additionally, small and medium-sized enterprises, which are significant sources of innovation in the industrial chain ecosystem, are not receiving enough support in comparison to large enterprises, hindering their ability to leverage digital technology innovations effectively and impacting the country’s economic development.

3.2 Lack of Professional Talent

The digital economy plays a prominent role in China’s economic development, and talent is a key driving force behind digital transformation, crucial for enhancing industrial chain resilience. However, the shortage of specialized talent and the backward construction of a digital technology interdisciplinary talent team hinder the speed of digital transformation. Although China’s talent

pool in computer and communication technologies is sufficient to meet market demand, there remains a gap between the supply of talent in digital technology fields like big data, the Internet of Things, and artificial intelligence, and market needs[10]. Additionally, China's basic education system focuses on improving citizens' overall quality but lacks a professional and vocational orientation, with limited exposure to digital technologies. In contrast, higher education is an important period for cultivating interdisciplinary digital technology talents, but some universities and research institutions' talent training models and systems lack innovation.

3.3 Weak Industrial Foundation

A strong industrial foundation is essential for the stability and modernization of industrial chains and plays a key role in driving high-quality economic development. While China's manufacturing industry is vast, the industrial foundation in terms of quality is relatively weak, with certain key industries being constrained by foreign technologies, resulting in incomplete industrial chains that limit resilience enhancement. For example, China's integrated circuit industry relies on imports for 80% of its circuits, with 33% of the global shipment value, yet the industry accounts for only 7% of the global total scale. This results in a higher risk of chain disruption in the integrated circuit industry and its upstream and downstream sectors. The fundamental cause lies in the difficulty of capturing and organizing implicit and tacit knowledge of technological talent in enterprises, which hinders its conversion into explicit knowledge that can be absorbed by later generations, thus limiting industrial foundation improvement.

4. Paths for the Digital Economy to Enhance Industrial Chain Resilience

4.1 Accelerating Digital Transformation

Amid the accelerating pace of digital transformation, speeding up the digital transformation of industrial chains has become a key path to enhancing industrial chain resilience. Data, as an emerging production factor, is crucial for resolving bottlenecks and connecting gaps in industrial chains, laying a solid foundation for activities like chain supplementation and extension. Digital infrastructure is key to generating, recording, collecting, storing, and utilizing data. Well-developed and efficient infrastructure plays an important supporting role in the process of digitizing elements, enterprises, and industrial chains. By strengthening top-level design of digital infrastructure and including the construction of new infrastructure as a priority, enterprises and industry associations can jointly build digital infrastructure platforms to collect and apply data from enterprises along the chain. As a critical factor, data should be regulated and interconnected through proper market rules to break down "information silos" along the industrial chain, promoting the integration of talent, technology, and innovation to build a favorable digital ecosystem for industrial chain digital transformation.

4.2 Building Digital Demonstration Platforms

Building digital demonstration platforms is crucial in the context of global digital transformation, as it drives changes in industrial chain development models and enhances industrial chain resilience[11]. Traditional single-chain development models can no longer meet the current complex and changing market demands, requiring a shift toward networked collaborative models. Data trading platforms serve as the foundation for business digital transformation, integrating abundant data resources to create large-scale datasets. The transformation of industrial chains is also dependent on these digital demonstration platforms, which help build resilient digital infrastructures

and networks to optimize information exchanges among industries and reduce risks. These platforms can encourage partnerships, facilitating shared resource use, optimizing logistics, and helping ensure smooth flows along the industrial chain.

4.3 Perfecting Information Sharing Mechanisms

Big data, as a novel production factor in the emerging industries, aids enterprises in acquiring industry information, creating value, and enhancing productivity, thus transforming business management and service models. This transformation strengthens the resilience of industrial chains, acting as a crucial driver for industry upgrades. In this developmental journey, it is essential to construct comprehensive digital information sharing mechanisms tailored to real-world applications, progressively enhancing the digital innovation capabilities of industrial chains and achieving precise integration between innovation chains and industrial chains. Digital technology holds unique advantages in maintaining the stability of industrial chains. Governments should utilize advanced digital tools such as artificial intelligence and cloud computing, in collaboration with relevant enterprises, to effectively organize upstream and downstream enterprise capacity information, understand distribution and potential development, and rapidly meet the production needs of various industries and regions[12]. This coordinated approach helps establish a nationwide emergency materials supply system, further ensuring the security and stability of industrial chains, promoting the sharing of digital technology innovations, strengthening the flow of innovative capital, and enhancing open cooperation across various fields to jointly drive the flourishing development of the digital technology ecosystem.

4.4 Leveraging the Supportive Role of Talent

Table 1: Measures to Leverage the Supportive Role of Talent

Measures	Content
National strategic demand orientation	Grasp the forefront of the digital development of industrial chains
	Aim at the major problem of industrial chain modernization development
	Lay out and build a gathering place for senior talents in the digital field
Introduce and cultivate talents	Introduce digital innovation talents of industry chain who master original and leading technology
	Optimize the industrial chain of digital talent structure
	Digital technology education throughout primary and secondary education and higher education
Reform the talent evaluation system	Abandon the hard and single standard of "only academic history theory"
	Establish an evaluation mechanism with technological innovation achievements as the core orientation

In the context of "Internet+", enhancing the resilience of industrial chains relies heavily on digital talents. Thus, cultivating interdisciplinary talents who integrate digital technology with industry development knowledge becomes a key measure. Adhering to national strategic needs, it is imperative to focus on cutting-edge areas of industrial chain digital development, targeting major issues in modern industrial chain development, and planning to establish hubs for high-level digital talent. Recruiting innovative digital talents with original and leading technologies for the industrial

chain will create high points of innovation in digital talents for industrial chains, optimizing the structure of digital talents for industrial chains. Whether in primary, secondary, or higher education, the integration of digital technology application throughout the educational system is crucial. This integration promotes a seamless connection between primary, secondary, and higher education in digital technology, fostering a conducive learning environment for digital technology. Simultaneously, in constructing talent evaluation systems, it is necessary to move away from rigid, singular criteria such as "only degrees" and "only scores," and establish an evaluation mechanism centered on technological innovation outcomes. This foundation will solidify the talent base necessary for enhancing the resilience of industrial chains in the digital economy , as shown in Table 1.

5. Conclusion

In the new era, the digital economy, as a significant economic engine, is profoundly impacting various domains of the socio-economic landscape with its efficiency, intelligence, and innovation. From transforming industrial structures to reshaping the job market, from revolutionizing consumption patterns to improving public services, the digital economy is continuously shaping the global economic and social landscape. As a new form of economy, through the extensive application of digital technologies, the digital economy injects new vitality into industrial chains, driving their transformation and upgrading on a broader and deeper level, and steering them towards high-end, intelligent directions.

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Key Laboratory of Philosophy and social Science in Hainan Province of Hainan Free Trade Port International Shipping Development and Property Digitization, Hainan Vocational University of Science and Technology, (No. Qiong Social Science [2022] 26)

References

[1] Feng YC, Gao Y, Xia XQ, Shi K, Zhang C, Yang L, ..., Cifuentes-Faura J. (2024). Identifying the path choice of digital economy to crack the "resource curse" in China from the perspective of configuration. Resour Policy 91.
[2] Guo BN, Wang Y, Zhang H, Liang CY, Feng Y, Hu F. (2023). Impact of the digital economy on high-quality urban economic development: evidence from Chinese cities. Econ Model 120:106194.
[3] Bhimani A. (2015). Exploring big data's strategic consequences. J Inf Technol 30:66–69.
[4] Brandon-Jones. (2014). A contingent resource-based perspective of supply chain resilience and robustness. J Supply Chain Manag 50(3):55–73.
[5] Christopher M, Peck H. (2004). Building the resilient supply chain. Int J Logist Manag. 15(2):1–13.
[6] Ding YB, Zhang HY, Tang ST. (2021). How does the digital economy affect the domestic value-added rate of Chinese exports? J Glob Inf Manag 29(5):71–85.
[7] Falk M, Biagi F. (2016). Relative demand for highly skilled workers and use of different ICT technologies. Appl Econ 49(9):1–12.
[8] Cheng C, Cui HF. (2024). Combining digital and legacy technologies: firm digital transformation strategies—evidence from Chinese manufacturing companies. Humanit Soc Sci Commun 11(1).
[9] Chen XY, Wan P, Ma ZF, Yang Y. (2024). Does corporate digital transformation restrain ESG decoupling? Evidence from China. Humanit Soc Sci Commun 11(1).
[10] Futtner U, Maklan S. (2011). Supply chain resilience in the global financial crisis: an empirical study. Supply Chain Manag: Int J 16(4):246–259.
[11] Gu H, Ryan C, Bin L, Wei G. (2013). Political connections, guanxi and adoption of CSR policies in the Chinese hotel industry: is there a link? Tour Manag 34:231–235.
[12] Feng YC, Pan YX, Lu S, Shi JX. (2024). Identifying the multiple nexus between geopolitical risk, energy resilience, and carbon emissions: evidence from global data. Technol Forecast Soc Change 208.