

Research on the Mechanism and Path of Generative Artificial Intelligence Restructuring the Digital Economy Industry Chain

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Abstract: Generative Artificial Intelligence (GAI), as a key driving force in the digital economy era, is profoundly reshaping enterprises' value creation methods and industry chain collaboration models. This paper focuses on GAI, systematically analyzing its internal mechanisms and evolutionary pathways in restructuring the digital economy industry chain, and constructs a path model for GAI-driven structural transformation. The study reveals that GAI promotes industry chain evolution towards intelligentization, platformization, and high-value segments through three core mechanisms: value creation, collaborative innovation, and platform ecosystems. Furthermore, GAI-driven industry chain restructuring undergoes a dynamic evolutionary process consisting of technological empowerment, organizational collaboration, and value innovation. The effectiveness of this restructuring is influenced by key factors such as enterprises' GAI technology integration capability, data resource openness and utilization capability, digital transformation level, and cross-enterprise collaboration capability. The theoretical contribution of this paper lies in enriching the research system in the fields of GAI and industry chain management, while practically, it offers a clear pathway for enterprises to achieve product innovation, process optimization, and collaborative upgrading based on GAI. However, this study primarily adopts a theoretical approach and lacks empirical validation at specific industry or enterprise levels. Future research could integrate typical industry cases to further explore application differences and governance strategies of GAI across various industry chains.

Keywords: Generative Artificial Intelligence; Digital Economy; Industry Chain

**Restructuring;
Collaborative
Ecosystem** **Value
Innovation;** **Creation;
Platform**

1. Introduction

With the rapid advancement of the digital economy, breakthrough developments in Generative Artificial Intelligence (GAI) are profoundly changing enterprises' value creation methods and industry chain collaboration models [1]. Representative GAI technologies such as ChatGPT and DeepSeek not only demonstrate strong empowerment effects in content production, product design, and intelligent customer service, but also drive the intelligentization of production processes and the transformation of organizational collaboration models, becoming a key driving force leading a new wave of industry chain restructuring. Compared with traditional digital technologies, GAI possesses stronger autonomous generation and innovation capabilities, deeply penetrating enterprise value chain activities and reshaping the structural forms and value creation logic of industry chains [2].

Currently, research on digital economy industry chain restructuring mainly focuses on areas such as digital transformation, networked collaboration, and intelligent manufacturing [3]. However, systematic studies from the perspective of GAI's mechanism and path in industry chain restructuring remain scarce, especially at the enterprise level. How GAI promotes deep structural and functional transformations of the industry chain through mechanisms of value creation, collaborative innovation, and platform ecosystems lacks systematic theoretical sorting and mechanism exploration.

Based on this, this paper takes Generative Artificial Intelligence as the research object and systematically analyzes its internal mechanisms and pathways in restructuring the digital

economy industry chain. The aim is to reveal the action mechanism of GAI empowering industry chain reconstruction and construct an evolutionary path model for GAI-driven structural transformation of industry chains. From an enterprise perspective, this research provides theoretical support and practical pathways for industry chain upgrading and value creation in the digital economy environment.

The significance of this study lies in: (1) Theoretically, deepening the understanding of the relationship between GAI and digital economy industry chain reconstruction, enriching the research system in the fields of digital economy and industry chain management; (2) Practically, offering feasible pathways and operational frameworks for enterprises to achieve product innovation, process optimization, and collaborative upgrading based on GAI, thereby enhancing their core competitiveness and value creation capabilities in the digital economy environment.

2. Literature Review

In recent years, as a significant branch of artificial intelligence, Generative Artificial Intelligence (GAI), leveraging its autonomous content generation and innovation capabilities [4], has rapidly become a focal point of attention in both academia and industry. GAI encompasses technologies such as large-scale pre-trained natural language generation models [5], image generation [6], and cross-modal content generation [7], with representative achievements including ChatGPT and DeepSeek. Numerous studies have pointed out that GAI not only enhances information production efficiency but also demonstrates broad application potential in personalized product design, intelligent customer service, and virtual assistants, becoming a key driving force for innovation in the digital economy [8].

Regarding the digital economy and industry chain restructuring, existing literature predominantly emphasizes the enabling effects of digital technologies such as big data, cloud computing, and the Internet of Things on traditional industry chains, highlighting how digital transformation fosters networked, platformized, and ecosystem-oriented development of industry

chains, thereby extending the value chain towards high value-added segments [9]. However, research specifically addressing the unique role of GAI in digital economy industry chains, particularly how it drives structural and functional transformations through intelligent generation and collaborative innovation, remains relatively scarce.

Some studies have explored the application of artificial intelligence technologies in the manufacturing industry, such as intelligent design and process optimization, revealing AI's role in enhancing production efficiency and innovation capacity [10], though mostly focusing on single segments. Other research has examined AI-driven multi-party collaboration and innovation mechanisms within platform ecosystems [11], yet lacks systematic analysis of GAI's overall action mechanisms. Furthermore, theoretical models on how enterprises integrate GAI to achieve flexible collaboration and value chain upgrading remain underdeveloped.

In summary, while existing studies provide a foundation for understanding industry chain transformations in the digital economy, the mechanisms, pathways, and key influencing factors of GAI-driven industry chain restructuring as an emerging core technology still require in-depth exploration. This paper, building upon existing research, aims to systematically sort out the internal mechanisms of GAI empowering digital economy industry chain restructuring and propose an exploratory theoretical framework for GAI-driven structural transformation, offering references for subsequent research and practical applications in related fields.

3. Theoretical Analysis

3.1 The Triple Mechanisms of GAI Restructuring the Industry Chain

Generative Artificial Intelligence significantly enhances product and service innovation capabilities and production efficiency through intelligent content generation, personalized product design, and process automation. Enterprises can leverage GAI to achieve rapid prototyping, automated content production, and intelligent customer service, reducing R&D and operational costs, enhancing customer

experience, and thereby improving overall value creation capabilities.

Simultaneously, GAI breaks the boundary constraints among enterprises within traditional industry chains, promoting flexible collaboration between upstream and downstream enterprises and platforms. Through intelligent recommendation, knowledge sharing, and data-driven collaborative decision-making, a dynamically adjustable supply chain network is formed, enabling optimized allocation of production resources and rapid response to market changes, thus advancing the evolution of industry chains towards intelligent collaborative ecosystems.

Based on GAI technology, enterprises are gradually building multi-sided platform ecosystems centered on data and algorithms, connecting suppliers, manufacturers, service providers, and end-users. This ecosystem fosters positive interactions through data sharing, algorithm collaboration, and open innovation, promoting value co-creation and benefit sharing among industry chain members, thereby enhancing the overall competitiveness of the industry chain.

3.2 Path Model of GAI-Driven Industry Chain Restructuring

GAI-driven industry chain restructuring is a dynamic evolutionary process. In the initial technological empowerment stage, GAI injects strong momentum into product design, content production, and intelligent services through large-scale pre-trained models and cross-modal generation technologies, becoming the core productive force within the industry chain. As the technology is further applied and deepened, enterprises enter the organizational collaboration stage, where they build flexible supply chains and intelligent collaboration networks with upstream and downstream partners based on GAI, driving profound changes in production organization methods. Finally, in the value innovation stage, through the construction of collaborative innovation and platform ecosystems, the industry chain realizes structural and functional restructuring, with the value chain gradually shifting towards innovation-intensive and high value-added segments, significantly enhancing the overall competitiveness and value creation capability of the industry chain.

3.3 Key Factors Affecting Industry Chain Restructuring Effectiveness

Key factors affecting the effectiveness of GAI-driven industry chain restructuring mainly include enterprises' GAI technology integration capability, data resource openness and utilization capability, digital transformation level, and cross-enterprise collaboration capability. These factors together determine whether enterprises can fully harness the transformative potential of Generative Artificial Intelligence within the industry chain.

The ability of enterprises to master and apply GAI technology directly determines their performance in product innovation and process optimization. Enterprises must possess not only the technical infrastructure but also internal capabilities to adapt GAI applications to business operations. Without sufficient integration ability, it is difficult to translate GAI's advantages into practical improvements in product design, service efficiency, and value creation.

High-quality and open-shared data resources provide a solid foundation for GAI models, significantly enhancing their intelligence and application effectiveness. Enterprises with robust data collection, management, and sharing mechanisms can ensure that GAI models are continuously optimized, making them more responsive to diverse business needs. Moreover, encouraging data openness within collaborative ecosystems enables upstream and downstream enterprises to share resources, jointly enhancing innovation capacity and operational efficiency. Additionally, the level of enterprises' digital transformation plays a crucial role in determining whether GAI technologies can be effectively embedded into daily operations. A higher degree of digital maturity allows enterprises to integrate GAI into workflows more smoothly, achieving intelligent automation and agile decision-making across the value chain.

Cross-enterprise collaboration capability is also a key factor affecting the success of GAI-driven restructuring. Building effective collaborative partnerships with suppliers, distributors, and technology partners ensures that GAI applications can exert synergistic effects across the entire industry chain. Only through enhancing technological, data, and organizational collaboration capacities can enterprises maximize the restructuring benefits

driven by GAI.

4. Conclusion

This paper systematically explores the internal mechanism and evolutionary path of Generative Artificial Intelligence (GAI) restructuring the digital economy industry chain, aiming to clarify how GAI, as an emerging core technology, drives the structural and functional transformation of industry chains. Through theoretical analysis, the following key conclusions are drawn:

Firstly, Generative Artificial Intelligence significantly enhances the innovation vitality and operational efficiency of enterprises by reshaping the value creation logic of the industry chain. By virtue of its powerful capabilities in intelligent content generation, personalized product design, and process automation, GAI enables enterprises to achieve breakthroughs in product and service innovation. Moreover, through data-driven decision-making and algorithm collaboration, GAI effectively promotes flexible collaboration among upstream and downstream enterprises, thus forming a dynamic and resilient supply chain system. The construction of multi-sided platform ecosystems centered on data and algorithms fosters cross-boundary resource integration and value co-creation, which continuously enhances the overall competitiveness and adaptability of the digital economy industry chain in a rapidly changing market environment.

Secondly, the process of GAI-driven industry chain restructuring is not a static or one-time transformation, but a dynamic evolutionary process characterized by progressive stages. In the initial stage of technological empowerment, GAI injects new productive forces into various links of the industry chain, significantly improving the efficiency of product design, content production, and intelligent services. As enterprises deepen the application of GAI, they gradually enter the organizational collaboration stage, where cross-enterprise knowledge sharing and collaborative innovation are promoted, leading to the formation of intelligent and flexible collaborative networks. Ultimately, in the value innovation stage, enterprises leverage platform ecosystems to realize the transformation of the industry chain from labor- and capital-intensive models to innovation-driven and high value-added models,

fundamentally enhancing the industry's overall value creation capability and structural resilience.

Thirdly, the effectiveness of industry chain restructuring driven by GAI is influenced by several critical factors. These include enterprises' capabilities to integrate GAI technology into business processes, the openness and utilization level of data resources, the extent of digital transformation across organizational structures, and the ability to foster cross-enterprise collaboration. Enterprises that can effectively harness these capabilities will be better positioned to leverage GAI for product innovation, process optimization, and collaborative upgrading. Conversely, organizations that lack the necessary technological and organizational foundations may face significant barriers in realizing the full potential of GAI-driven transformation. Therefore, a comprehensive enhancement of technological capability, data governance, and collaborative innovation capacity is essential to ensuring the success of industry chain restructuring initiatives.

The theoretical contributions of this paper are reflected in the construction of a mechanism and path model for GAI empowering digital economy industry chain restructuring, which enriches the theoretical research framework in the fields of artificial intelligence application and industry chain management. By bridging the gap between GAI technology and practical industrial applications, this research provides a valuable analytical lens for understanding the transformative role of emerging technologies in reshaping traditional industry chain structures.

On a practical level, the findings of this study offer actionable insights and strategic guidance for enterprises seeking to enhance their core competitiveness in the digital economy environment. By clarifying the pathways through which GAI can be integrated into value chain activities, enterprises can formulate targeted strategies to achieve product innovation, optimize production processes, and build robust collaborative ecosystems. This, in turn, will enable them to respond more effectively to market uncertainties and competitive pressures, thereby achieving sustainable growth and long-term value creation. Nevertheless, this study is primarily theoretical and lacks empirical validation based on specific industry practices or enterprise cases. The

complexity and diversity of GAI applications across different industry chains mean that the mechanisms and pathways proposed in this paper still require further empirical exploration and refinement. Future research should focus on conducting in-depth case studies in typical industries, examining how enterprises with varying digital maturity levels integrate GAI to achieve industry chain upgrading. Moreover, the challenges related to data security, privacy protection, and ethical risks brought by GAI applications should also be carefully examined, as these factors will have a profound impact on the governance models and operational strategies of digital economy industry chains. Addressing these emerging challenges will be crucial for ensuring that GAI-driven industry chain restructuring progresses in a sustainable, ethical, and secure manner.

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