

A Literature Review of Firm Innovation and Industrial Reform Driven by the Digital Economy

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Abstract

With digital economy-driven firm innovation and industrial reform as the core research focus, this paper systematically sorts out relevant academic research achievements from both domestic and international sources, clarifies the research trajectory and core issues in the existing literature, and further explores the inherent development logic of the global digital economy. Centering on the influence mechanism of the digital economy on firm innovation and industrial reform, existing academic research has established a theoretical analytical framework that demonstrates how the digital economy drives enterprise innovation, fuels industrial transformation and delivers high-quality economic development through multiple dimensions: macro-level institutional guarantees, mid-level industrial transformation and micro-level enterprise innovation. This paper conducts in-depth discussions from five dimensions: fundamental theories, micro-level innovation, mid-level industrial development, macro-level welfare, and institutional adaptation. It also puts forward prospects for future research, to provide a reference for subsequent academic research and industrial practice in related fields.

Keywords

digital economy, data factor, firm innovation, industrial transformation

1. Introduction

The global digital economy has maintained sustained expansion and emerged as a core force driving global economic growth, advancing firm innovation, and reshaping the industrial landscape. As a core factor of production, the data factor acts as the fundamental engine for the development of new quality productive forces. According to Huawei's Global Digital Intelligence Index (GDII) 2025, with the full advent of the digital-intelligence economy era, the scale of the global digital-intelligence economy reached USD 26.7 trillion in 2025, accounting for 25% of global GDP [1]. The input-output ratio of digital-intelligence transformation stands at 1:9.55, highlighting the prominent and growing value of industrial digital transformation.

As digital transformation evolves in depth toward a full-chain, ecosystem-based paradigm, the Digital Economy Trends 2025 released by the Digital Cooperation Organization (DCO) identifies the release of structural dividends, including the commercial application of AI technologies, the upgrading of computing

power infrastructure, and the deep penetration of industrial digitalization, as its primary growth momentum [2].

Against this background, this paper explores the influence paths and action mechanisms through which the digital economy drives firm innovation and industrial reform, traces the underlying economic theoretical frameworks, and puts forward prospects for future research.

2. Theoretical Framework

Amid the in-depth advancement of the global digital economy, the shared attribute of data factors continues to unleash growth dividends, driving a comprehensive shift in the logic of global economic growth from the traditional factor-driven model to a paradigm powered by new quality productive forces. The digital economy acts as the core driver of digital innovation for firms, and the convergence of collaborative innovation among micro-economic agents in turn propels industrial digitalization reform to advance in greater depth.

Existing studies, anchored in the logical interconnections and academic connotations of the three core concepts, digital economy, firm innovation, and industrial reform, examine the theoretical origins and research consensus on data factors. Relevant research progress can be summarized in the following dimensions.

2.1 The Principle of Increasing Returns to Scale for Shared Factors

The shared characteristic of data factors serves as the logical starting point of research in this field. As a typical shared factor of production, data can be simultaneously reused by multiple economic agents without attrition in use, featuring accessibility, replicability and infinite supply. It breaks through the constraint of diminishing marginal returns on economic growth imposed by the limited supply of traditional factors of production, including land, labor, capital and technology. When the scale of data accumulation exceeds a critical threshold, it will trigger a sustained effect of increasing returns to scale, which constitutes the underlying economic logic that distinguishes the digital economy from the traditional industrial economy.

Foreign academia took the lead in completing groundbreaking foundational theoretical work on this topic. In their seminal review, Goldfarb & Tucker systematically defined five core attributes of the digital economy for the first time, non-rivalry, zero marginal cost, network effects, and new forms of information asymmetry, and identified the unique endowment of data as a new factor of production [3].

Building on this, Jones & Tonetti formally incorporated “shared” as the core essence of data factors into the endogenous growth model, that was proved to be the economic attribute of data shared from a theoretical perspective in the landmark study, pointing out that data can be reused infinitely without attrition. This characteristic completely breaks the law of diminishing marginal returns governing traditional factors of production, and represents the core underlying logic that enables data factors to drive sustained economic growth [4].

Chinese scholar conducted empirical tests using China’s industrial panel data from 2012 to 2025, grounded in the practice of China’s industrial digital economy. Breaking through the framework of traditional linear production theory, Chinese scholar proposed the proposition of ‘structural substitution and nonlinear empowerment’, and verified that the nonlinear driving effect of data factors on total factor productivity (TFP) is far stronger than that of traditional factors of production [5].

2.2 The Principle of Data-Driven Growth via Endogenous Knowledge Accumulation

The digital economy extends the boundaries of traditional endogenous growth theory. Massive volumes of production and user behavior data serve as an entirely new raw material for knowledge accumulation. Through big data analytics, the codification and diffusion of tacit knowledge can be realized rapidly, significantly accelerating the efficiency of knowledge iteration. Under a sound privacy protection framework, this mechanism can break through the growth limit of traditional knowledge accumulation and underpin long-term sustainable endogenous growth of the economy.

Cong et al. deeply integrated data factors with traditional endogenous growth theory and constructed a dynamic general equilibrium (DGE) model with knowledge accumulation, privacy protection and economic

growth as core variables [6]. The study proves that data-driven knowledge accumulation can deliver long-term endogenous growth and strike a long-run balance between data utilization and privacy protection.

Liu et al. verified this mechanism using China's macro-economic data, confirming that the data factor has emerged as a new core driving force supporting China's economic growth [7].

2.3 The Principle of Network Collaborative Value Creation in Data Ecosystems

Digital platforms have completed the transformation from the traditional techno-economic intermediary model of supply-demand transactions to a techno-ecological data value network. Enabled by the smooth cross-agent flow of data factors, multiple economic agents within the ecosystem, including users, suppliers and service providers, form a distributed value network. Value multiplication was achieved through data sharing and reuse, such that the overall aggregate value of the ecosystem ultimately far exceeds the sum of values independently created by individual agents.

Toorajipour et al. deconstructed the value capture mechanism of data ecosystems in the context of Artificial Intelligence of Things (AIoT) scenarios, and verified the value creation advantage of multi-agent collaboration [8]. Drawing on the development practice of domestic platforms in China, Xu et al. systematically demonstrated the complete path of the transformation of Chinese digital platforms toward the ecosystem model [9].

2.4 The Principle of Institutional Adaptation and Evolution for Digital Innovation

Technological progress does not automatically translate into sustained innovation dividends. The efficient operation of the digital economy is highly reliant on the support of an adaptive institutional system. Clear property rights rules, reasonable benefit distribution mechanisms, and a regulatory framework that balances data utilization and protection can effectively reduce data transaction costs and fully incentivize market entities to make digital investments. Such a sound institutional framework serves as the core underpinning for unlocking long-term innovation potential.

3. Literature Review

Rooted in these core theoretical foundations, the Principle of Increasing Returns to Scale for Shared Factors, the Principle of Data-Driven Growth via Endogenous Knowledge Accumulation, the Principle of Network Collaborative Value Creation in Data Ecosystems, and the Principle of Institutional Adaptation and Evolution for Digital Innovation, this paper organizes its systematic review of key domestic and international research outputs along a three-tier logical sequence: micro-level innovation, mid-level industrial development, and macro-level institutional arrangements. The review further synthesizes the central contributions and pivotal arguments put forward in extant scholarship, delineates how prior research streams align with this paper's analytical framework, and ultimately maps out the full intellectual lineage of the relevant body of literature, which is concerned with digital economy-driven firm innovation and industrial reform, clarifies the research trajectory and core issues.

3.1 Micro-Level Firm Perspective: Digital Economy Reshapes Innovation Behavior and Growth Pathways

Driven by the digital economy, firm-level innovation follows an evolutionary trajectory that progresses from discrete technology applications to full-chain innovation restructuring. Huang Bo et al. deliver the first large-sample empirical analysis focused on China that employs "firm digital patents" as core micro-level evidence, an analytical design that fundamentally resolves the long-standing methodological challenge of measuring digital technology adoption [10].

Specifically, this study operationalizes digital patents as patent assets tied to artificial intelligence, big data, and cloud computing, which are screened and extracted from enterprises' full patent portfolios. Drawing on a matched dataset of Chinese industrial firms spanning the 2000 to 2021 period, its empirical estimations demonstrate that firms' deployment of digital technologies significantly enhances total factor productivity, improves the structure of product exports, and reduces energy intensity—all of which collectively steer firms toward high-quality development. As the most rigorous empirical evidence to date on the micro-level

innovation effects of digital technologies, this work has been extensively cited in subsequent domestic research and is widely regarded as a benchmark result in the field.

3.2 Mid-Level Industry Perspective: Ecological Transformation and Integrated Upgrading of the Real Economy

As the digital economy restructures the underlying logic governing firm innovation and growth, the convergence of innovative activities across a broad range of microeconomic actors gives rise to synergistic effects. These effects in turn propel the iterative transformation of the entire industrial system, driving its structural evolution from a linear industrial chain architecture to an ecosystem-centric organizational configuration.

Toorajipour et al. focused on industrial ecosystems within the specific technical context of the Artificial Intelligence of Things (AIoT) [8]. The study notes that under the traditional linear business model, value is created and appropriated exclusively by a single firm. In contrast, under the data ecosystem model, all participating firms contribute their own scenario-specific data; the incremental value generated by the circulation and reuse of data within the ecosystem is shared by all stakeholders, ultimately maximizing the overall value of the ecosystem. This study provides a complete analytical framework for industrial business models in the era of the Internet of Everything.

Xu Xiang et al. sorted out the evolutionary path of digital platforms in China, and summarized that China's digital platform industrial model has completed the shift from the initial tech-economic paradigm to a tech-ecological paradigm [9]. It has evolved from a transaction intermediary that generates revenue by reducing transaction costs via digital technologies, into a value chain connector that leverages data factors as a core hub to enable cross-agent flows among users, suppliers and service providers, thereby building a collaborative innovation network covering the entire industrial chain.

The structural substitution effect of data factors will gradually permeate all segments of traditional industries, driving the upgrading of traditional industrial production modes toward intelligent and green development, and realizing the in-depth integration of the digital economy and the real economy. Meanwhile, the shared attribute of data factors significantly accelerates knowledge spillovers, enabling industrial innovation outcomes to diffuse rapidly across multiple agents. This drives an overall uplift in the technological level of the entire industry, and ultimately propels the industrial structure to transform toward high-end and intelligent development.

3.3 Macro-Level Institutional Perspective: Optimization of Factor Allocation and Institutional Safeguards Unleashing Long-Term Growth Momentum

The favorable impacts of industrial ecological transformation and the integrated upgrading of the real economy will ultimately transmit to the macroeconomic level. At the macro dimension, the digital economy unleashes long-term growth momentum through the dual mechanisms of institutional adaptation and market optimization.

Liu et al. verified the two functioning channels of data factors, direct empowerment of production and indirect promotion of innovation, using China's macroeconomic data and systematically constructed a complete mechanism framework for data factor-driven economic growth in China [7]. The study identifies three core transmission paths: first, reducing information asymmetry to optimize the efficiency of resource allocation across the whole society; second, accelerating knowledge spillovers to raise the speed of technological progress across all industries; third, generating jobs through innovative business formats to expand the boundaries of economic growth. Based on China's macroeconomic data from 1990 to 2023, the estimation shows that data factors contribute more than 25% to China's economic growth, and the contribution is still rising continuously, that is making a core driving force underpinning the high-quality development of China's economy [7].

Li et al. focused on the design of the property rights system for data factors, and constructed a theoretical model incorporating data investment incentives, data sharing efficiency, and property rights allocation rules [11]. The study points out that clearly defined data property rights are the core prerequisite for promoting market entities to increase data investment. When the incremental benefits of data are reasonably distributed

among data providers, data processors and data users in proportion to their contributions, sharing costs decline, and the circulation efficiency of the entire data factor market can reach its optimal level [11]. This study provides a direct theoretical basis for the construction of China's data factor property rights system.

From the perspective of long-term economic history, Tomizawa et al. demonstrated that innovation is not a spontaneously occurring process, and argued that a sound institutional environment supported by compatible property rights protection, incentive mechanisms and regulatory systems, which forms a positive circular mechanism of 'institution, innovation and growth', serves as the core guarantee for driving sustained innovation advancement and realizing sustainable economic growth [12].

4. Key Finding

Existing domestic and international scholarship has established a complete research chain spanning from foundational theories to micro-level empirical evidence, and reached three core consensus findings:

- Finding 1: The shared and increasing marginal returns of data factors constitute the core underlying logic that distinguishes the digital economy from the traditional industrial economy, and serve as the source of all its empowerment effects.
- Finding 2: The digital economy-driven firm innovation and industrial reform is a systemic whole-chain restructuring that extends from micro-level enterprises to mid-level industries and further to the macro-economy.
- Finding 3: With a sound institutional system as the premise of the digital economy. Relying on data as a new type of shared factor of production, with its inherent feature of infinite reuse and circulation at near-zero marginal cost, the digital economy systematically reshapes the efficiency rules and value distribution logic of the entire economic system. Progressing layer by layer from micro-level enterprise innovation to mid-level industrial transformation, they jointly constitute a complete logical chain driving the high-quality development of the digital economy, and also provide an analytical foundation for research in related fields.

Industrial digitalization reform represents the mid-level industrial transformation path formed after the synergistic effects of micro-level enterprise innovations materialize. By promoting the transformation of digital platforms from the traditional tech-economic supply-demand transaction intermediary model to a tech-ecological data value network, it achieves the systemic upgrading of production modes, organizational forms, and business models across the entire industrial chain.

5. Discussion

5.1 Limitation

Nevertheless, three notable research gaps remain evident in the existing body of literature: First of all, existing research has devoted insufficient attention to the synergistic agglomeration effects between data factors and traditional production factors, including land, labor, capital and technology. Systematic inquiry into the complete transmission chain of 'data factors, firm innovation and industrial reform' remains inadequate, with observable discontinuities in cross-level mechanism analysis.

What's more, prominent theoretical gaps persist regarding the identification of data copyright infringement and the value evaluation system under generative AI scenarios. Research on segmented scenarios within China's domestic high-end manufacturing and strategic emerging industries is still lacking, and the characterization of heterogeneous features of digital reform across industries is insufficient, which can hardly accommodate the rapid development of the large model industry.

Last but not least, existing studies predominantly sample leading platforms and large enterprises. Discussions on the new mechanisms and features of inclusive innovation, including how micro, small and medium-sized enterprises (MSMEs) can obtain equitable access to data factors, still require further in-depth exploration.

5.2 Future Research

In conclusion, there remains substantial scope for expansion in future research. In terms of deepening transmission mechanisms, future studies should further break down research boundaries across the micro, mid and macro levels, to construct a complete multi-level transmission model. And the future research would be better to quantitatively measure the contribution share of data factors at every link from underlying attributes to ultimate industrial growth.

In terms of heterogeneity expansion, segmented scenario research should be carried out for enterprises of different industries and size categories, to summarize the differentiated paths of digitalization reform across industries and formulate guiding conclusions with stronger practical operability.

In terms of frontier technology adaptation, research should focus on new technology scenarios such as generative AI and multi-modal large models, explore new forms and mechanisms of innovation driven by the digital economy, and fill the research gaps in existing theories against the backdrop of emerging technologies.

In terms of institutional innovation research, aligned with the latest practices in the development of China's data factor market, future studies should explore optimal institutional pathways for data property rights, data trading and data regulation tailored to China's context, so as to provide more solid theoretical support for policy formulation.

6. Conclusion

Existing academic contributions have well-constructed a full-chain transmission path through which the digital economy drives enterprise innovation, fuels industrial transformation and delivers new high-quality economic development via multi-dimensional channels: macro-level institutional guarantees, mid-level industrial transformation and micro-level enterprise innovation.

However, existing research is insufficient in summarizing the heterogeneous characteristics of digital transformation across industries. There are notable theoretical gaps in the data value assessment system for diverse application scenarios, and the development paths of enterprises of varying sizes driven by the digital economy remain to be explicitly clarified.

Accordingly, conducting in-depth exploration of heterogeneity across industries and enterprise scales, carrying out scenario-specific segmented research, and deriving more actionable guiding conclusions through extensive empirical analysis represent a critical direction for future research on the impact paths and functional mechanisms of the digital economy in driving enterprise innovation and industrial reform.

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Conflicts of Interest

The authors declare no conflict of interest.

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