Proceedings of the 10th International Conference on Economic Management and Green Development
DOI: 10.54254/2754-1169/2026.35413

Digital Penetration and Value Reconstruction: An Analysis of the Paradigm Shift in the Innovative Economy Driven by Fintech

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Abstract. Fintech, as a new generation of universal technology, is profoundly reshaping the value creation and distribution logic of the economic system. Based on the theory of technological economic paradigm, this article systematically reviews the existing literature on how digital penetration and value reconstruction promote the transformation of economic paradigm. By tracking the theoretical evolution of economies of scale, economies of scope, and network effects, three key mechanisms of financial technology to enhance network connectivity, reduce transaction friction, and promote value co creation are summarized. Research has shown that the positive impact of financial technology on macroeconomic efficiency has been widely recognized, but the continued widening of the digital divide and the potential accumulation of systemic risks have also raised deep concerns in academia. Finally, this article points out that current research is relatively lacking in cross-border comparative analysis, and exploration of long-term structural impacts is also insufficient. Based on this, future research directions and policy recommendations are proposed.

Keywords: Fintech, technological-economic paradigm, digital penetration, value reconstruction, network effects

1. Introduction

As a new generation of general technology, financial technology is profoundly reshaping the value creation logic and resource allocation paradigm of the economic system, and promoting the transformation of the technology-economic paradigm from traditional scale economy to scope economy and network effect. Based on the theoretical framework of the technology-economic paradigm proposed by Carlota Perez [1], this paper systematically reviews the existing literature on digital penetration and value reconstruction driving the transformation of the innovative economy. The study first traces the academic lineage of theoretical evolution: from the production cost logic of neoclassical economics to the network connection logic of platform ecosystem under the information and communication technology, and sorts out the core mechanism line of "digital penetration reduces transaction friction - network connection enhances collaborative density - cross-border effect fosters value co-creation". At the level of current status review, this paper summarizes the empirical findings of mobile payment, digital credit and blockchain applications in improving

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financial inclusiveness and macro efficiency from three dimensions: the depth of technology penetration, the breadth of ecosystem construction and the effectiveness of institutional response [2, 3]. Taking platforms such as Ant Group as typical cases, it analyzes the dynamic process of the financial ecosystem, realizing value reconstruction through the expansion of the scope economy [4]. Furthermore, the article explains from two analytical perspectives, digital penetration and network effects, value reconstruction and scope economy, how financial technology can reshape the temporal and spatial constraints and organizational boundaries of resource allocation by weakening information asymmetry, promoting the fragmented circulation of rights and interests and the automatic execution of smart contracts [5].

The review shows that existing literature generally recognizes the positive role of financial technology in reducing transaction costs and stimulating total factor productivity of enterprises [6], but also repeatedly warns of structural concerns such as the widening digital divide, the accumulation of risks from algorithmic collusion, the solidification of data monopolies, and regulatory lag [7]. Based on this, this paper predicts three trends in the future paradigm evolution: the coexistence and penetration of centralized platforms and decentralized protocols, the deep integration of programmable economy and embedded finance, and the gradual adjustment of institutional supply from passive response to agile regulation. The marginal contribution of this paper is: first, it integrates the evolutionary logic of the three major theories of economies of scale, economies of scope, and network effects, and clarifies the core driving force of "connectivity-oriented" replacing "scale-oriented" in the paradigm transformation of financial technology; second, it systematically points out the weaknesses of existing research in cross-border institutional comparison, long-term structural impact assessment, and the construction of a unified quantitative indicator system. Accordingly, this paper proposes future directions such as building an agile regulatory framework that takes into account both innovation incentives and risk prevention, strengthening cross-border financial governance coordination, and expanding multi-country comparative empirical research.

2. Theoretical evolution of technological-economic paradigm shift

The theoretical starting point of the technological-economic paradigm shift lies in the decline of the explanatory power of the neoclassical scale economy framework in the face of the digital ecosystem. Traditional analysis attributes the source of efficiency to the unit cost reduction brought about by the expansion of production scale, but the cost structure of digital products and services presents an atypical feature of high fixed input and near-zero marginal replication, making it difficult for the simple scale logic to capture the essence of value creation. The sign of the theoretical shift is Carlota Perez's systematic explanation of the law of co-evolution of technological revolution and institutions [1]: Every penetration of general technology redefines the most efficient way of organizing economic activities by fundamentally changing the relative cost structure of key elements. As a general technology with data as its core element, financial technology has dismantled the information monopoly and geographical barriers of traditional intermediaries by significantly reducing transaction costs such as information search, identity verification and contract execution, and promoted the shift of the focus of value creation from the scale expansion of the supply side to the network connection of the demand side [8]. In this process, scope economy and network effect replace scale economy as the dominant mechanism, and the form of economic organization shifts from vertical integration level to multilateral platform and ecological collaboration. The underlying dynamic principle of this theoretical evolution can be summarized as "changes in transaction cost

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structure trigger changes in organizational logic," but the quantitative determination of the critical conditions for paradigm shifts remains a weak link in the current theoretical development.

3. Current status of economic paradigm transformation driven by fintech

From a review perspective, existing literature depicts the current landscape of paradigm shift around three threads: technological penetration, ecosystem construction, and institutional response. In terms of technological penetration, the deep embedding of data processing and intelligent algorithms has shifted credit assessment from static collateral logic to dynamic behavioral profiling, fundamentally reshaping the information basis of risk pricing [2]. In terms of ecosystem construction, multilateral platforms, driven by cross-border network effects, enhance the participation value of another group of users through the expansion of one group's user base, forming a self-reinforcing positive feedback loop, thus extending competitive advantage from a single product to the collaborative capabilities of the ecosystem [4, 9]. In terms of institutional response, the emergence of regulatory experimental tools is essentially an adaptive adjustment of governance logic to the accelerated iteration of technology, aiming to seek a dynamic balance between innovation incentives and risk prevention [10]. These three threads together reveal the core characteristics of paradigm shift: the basic connection methods of economic activities, organizational coordination mechanisms, and institutional constraints are undergoing simultaneous structural migration. However, the literature also generally reveals the unevenness of the transformation process —the self-reinforcing tendency of network effects naturally has an inherent tendency towards market concentration, the automation of algorithmic decision-making allows collusive behavior to be realized implicitly rather than explicitly through contracts, and the differentiation mechanisms of paradigm evolution paths under different institutional environments still need systematic comparison. This essentially points to a deeper, more fundamental proposition: how institutional variables shape the direction and boundaries of the penetration of general technologies is the key to understanding the differentiated approaches to paradigm transformation.

4. The impact of digital penetration and value reconstruction on economic paradigm shift

The essence of digital penetration lies in the systematic embedding and reorganization of data elements into traditional production factors. Taking Kenya's mobile payment platform M-Pesa as an example [11, 12], since its launch in 2007, the system has covered more than 80% of the adult population in the country, driving the country's financial inclusion rate to jump from 26% in 2006 to 84.8% in 2024. This has been repeatedly confirmed by multiple sets of empirical data. The information economics principle of this process is that the continuous decline in the cost of data collection, transmission and analysis has enabled credit assessment to shift from a model that relies on static collateral and offline relationships to a dynamic characterization based on multi-dimensional behavioral data, thereby structurally weakening information asymmetry. On this basis, value reconstruction constitutes the logical extension of the deepening of digital penetration. Its core lies in the fact that digital technology has changed the way economic rights are defined, divided and circulated. According to industry research statistics, the real-world asset (RWA) tokenization market has achieved significant growth between 2024 and 2025 alone. The tokenization of US Treasury bonds, corporate bonds and real estate has enabled investors to obtain interest-bearing assets on-chain and obtain unprecedented liquidity and transparency. From the perspective of the techno-economic paradigm, the significance of this phenomenon lies in the fact that traditional assets have long been in an indivisible and fixed state due to the high cost of splitting and the heavy barriers to

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circulation. However, the technical mechanisms such as standardized equity units, automatic execution of smart contracts and distributed recording have greatly reduced the institutional friction of fine-grained equity splitting and low-cost circulation, and extended the logic of realizing economies of scope from the sharing of production links within enterprises to the dynamic matching between diversified demand and modular supply in the entire digital ecosystem. At the platform ecosystem level, the cutting-edge research of Cong et al. revealed a more refined mechanism: the key feature that distinguishes financial technology platforms from non-financial platforms is that they have platform-level cross-side network effects (p-CNEs) [13]. Their empirical research using Chinese market lending data as a sample shows that the p-CNEs of lenders on growth or emerging platforms are significantly higher than those on declining or mature platforms, and the p-CNEs of lenders can effectively predict the probability of platform survival. This finding empirically confirms the core insight of Perez's technology-economy paradigm theory [1]: the diffusion of general technologies does not unfold linearly and uniformly, but rather undergoes a non-equilibrium evolution path from the critical scale breakthrough in the initiation period to the solidification of the market structure in the mature period, under the condition that there are stage differences in the strength of network effects.

5. Development trends and challenges of economic paradigm shift

5.1. Development trends

Based on the consensus of the current literature, the evolution of paradigm shift can be grasped from three levels. First, the protocolization and hybridization of organizational forms. As the distributed trust mechanism matures, the coordination of economic activities is gradually shifting from relying on the intermediary guarantee of centralized platforms to a hybrid architecture in which decentralized protocols based on cryptographic verification coexist and permeate with centralized platforms [10]. This coexistence is not the inevitable demise of centralized platforms, but more likely to be a hybrid architecture in which technological trust and institutional trust alternately dominate in different scenarios. The underlying logic is that the difference in the trust cost structure of different economic activities determines that the optimal governance mechanism is not a single form. Second, the programmability of economic activities. The rapid rise of embedded finance provides a concrete footnote to this trend. Kenya's digital bank NCBA LOOP has directly embedded credit and payment functions into a single transaction process, fundamentally eliminating the process barriers between traditional credit applications and payment behaviors. At the same time, the global market size of embedded finance is expected to grow from US$264 billion in 2021 to US$606 billion in 2025 [14]. From the theoretical lens of the techno-economic paradigm, this means that financial services are shifting from an independent "product distribution" logic to a "function call" logic that is accompanied by real-time physical business processes—the coded embedding of payment, settlement and credit functions allows transaction costs to be systematically eliminated at the front end of the business process. Thirdly, the deep integration of financial technology and the real economy is going beyond the digitalization of channels and entering the reorganization of factors. Taking the process of Ant Group establishing the Alipay ecosystem in Malaysia as an example, this exploratory case study shows [15] that the international expansion of financial technology platforms is not a simple export of payment tools, but a multi-layered institutional coupling process involving local regulatory adaptation, user behavior cultivation and ecosystem partner collaboration [4, 9].

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5.2. Challenges faced

While releasing efficiency dividends, paradigm shifts also bring structural challenges stemming from their inherent logic. These challenges can essentially be seen as an inevitable product of the uneven diffusion of general technologies. First, digital penetration itself follows an asymmetric path. Differences in technological cognition, infrastructure access, and institutional adaptability lead to significant disparities in the participation capacity and benefits of different groups and regions in the new technology paradigm. For example, in South Africa, although mobile connectivity has covered more than 95% of households and about 79% of the population are internet users, the latest research continues to warn that without prudent policy intervention, structural inequality, skills deficits, and infrastructure gaps are likely to deepen existing social exclusion rather than bridge the digital divide [16]. Second, the combination of network effects and data assets has an inherent tendency towards market concentration. Cong et al.'s empirical study on platform-level cross-side network effects further revealed an empirical law with profound regulatory implications: the network effect strength of mature platforms tends to decrease, while the network effect of newly entered platforms is more significant [13]. This finding suggests that, in the absence of an effective competitive governance framework, the data asset accumulation and user scale accumulation completed by early platforms with their first-mover advantage may solidify into a structural barrier that is difficult for later entrants to overcome. Furthermore, while expanding the accessibility of financial services, the credit expansion driven by fintech has also triggered the serious problem of excessive consumer debt. A recent study based on a dual case comparison of Kenya and Brazil pointed out that the rapid penetration of fintech into low-income groups has induced excessive expansion of consumer credit in both countries. If there is a lack of appropriate regulatory design and social policy support, the continued expansion of credit options will not only fail to reduce inequality but may instead transform financial inclusion into a transmission channel for the continuous rise in debt-to-income ratios [17]. This warning is highly consistent with the inherent tension of financial capital expanding itself out of the productive base during the "frenzy period" in Perez's theory - the lag of technology-institutional coupling is precisely the root cause of the systemic risk of paradigm shift. Finally, traditional regulation is rooted in static license management and territorial jurisdiction boundaries, while the cross-border penetration of financial technology activities and the high speed of technological iteration have made the "relative lag" of rule-making rise from a degree problem to a structural dilemma [1]. The latest research by the International Monetary Fund on interoperability between the Unified Payments Interface (UPI) of India and existing financial technology platforms [18] shows that network integration can increase the total usage of digital payments by more than 50% within one year after integration, but the competitive effect of interoperability is highly dependent on the initial market structure and the distribution of platform power. This finding has direct policy implications for the institutional design of cross-border regulatory coordination. These challenges together reveal a deep proposition: the final direction of paradigm shift is not a one-way linear result of technology embedding, but an open process of continuous game and mutual shaping between technological logic and institutional logic. The differences in institutional variables will largely determine the direction, pace and distribution effect of general technology penetration.

6. Conclusion

This paper, based on the theory of the techno-economic paradigm, systematically reviews existing literature on the transformation of the fintech economic paradigm driven by digital penetration and value reconstruction. Research shows that the transformation of the techno-economic paradigm

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follows a discernible internal logical chain: the neoclassical framework of economies of scale exhibits limitations in its explanatory power due to the structural characteristics of digital products, which exhibit both high fixed costs and near-zero marginal costs. Fintech, as a general-purpose technology with data as its core element, significantly reduces key transaction costs such as information search, identity verification, and contract execution, altering the connection topology and collaboration patterns between economic entities. This drives the shift in value creation focus from supply- side scale expansion to demand-side network connectivity, thus making scope economies and network effects the dominant mechanisms of the new paradigm, replacing scale economies. At the level of transformation mechanisms, digital penetration weakens information asymmetry, fostering a new resource allocation dynamic of cross-border network effects. Value reconstruction, through standardized equity units and automatic execution of smart contracts, significantly reduces institutional friction in the fine-grained segmentation and circulation of equity, leading to the inherent inevitability of market concentration resulting from the self-reinforcing tendency of network effects and the combination of data assets. Furthermore, there is a structural tension between the static licensing logic and the territorial boundaries of traditional regulation and the cross-border penetration of fintech activities.

This paper's marginal contributions are reflected on two levels: Theoretically, by integrating the evolutionary logic of economies of scale, economies of scope, and network effects, it clearly reveals the inherent dynamic principle of "connectivity-oriented" replacing "scale-oriented" in the paradigm shift of fintech, and unifies cross-border network effects, the expansion of economies of scope, and the self-reinforcing cycle of value co-creation within the core mechanism framework of "changes in transaction cost structure leading to organizational logic transformation." In terms of literature identification, it systematically points out the weaknesses of existing research in three directions: First, the quantitative definition of the critical conditions for paradigm shift lacks a unified indicator system, leaving stage determination still at the level of qualitative description; second, cross-border institutional comparative studies are scarce, failing to systematically answer the profound question of "how institutional variables shape the direction and boundaries of general technology penetration"; third, the tracking and evaluation of the long-term structural impacts of fintech, especially in dimensions such as employment substitution, income distribution effects, and dynamic evolution of market structure, lags far behind the accumulation speed of short-term efficiency research. These gaps collectively point to a methodological dilemma: current literature mainly focuses on cross-sectional analysis of single countries, making it difficult to capture the dynamic evolutionary process of technology-institution coupling.

Based on the foregoing conclusions, this paper proposes three policy recommendations. First, build an agile regulatory framework that adapts to paradigm shifts. It leverages experimental tools including regulatory sandboxes to strike a dynamic balance between encouraging innovation and guarding against risks, avoiding the amplification of systemic risks by laggard regulations, Special attention shall be paid to the implicit mechanisms of algorithmic collusion, as well as the competition policy implications arising from the diminishing network effects of mature platforms. Second, digital inclusion should be placed on the core agenda of fintech development. By improving infrastructure accessibility, offering digital literacy training and rolling out tailored consumer protection systems, authorities can alleviate the worsening impact of unbalanced technology diffusion on pre-existing structural imbalances, so that financial inclusion will not be distorted into a debt-fueled exclusion mechanism. Third, international coordination on cross-border fintech governance needs to be reinforced. Multilateral dialogue mechanisms and information-sharing frameworks ought to be created to tackle data monopolies, decentralized financial risks and cross-

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border algorithm supervision. Future research can be further advanced in three dimensions: developing a unified quantitative indicator system for the techno-economic paradigm to identify the critical tipping point of transformation; conducting cross-national comparative empirical analyses across diverse institutional settings to verify the moderating effects of institutional variables; and building long-term tracked panel datasets to evaluate the profound structural influences of fintech on employment structures, income distribution and market competition landscapes.

References

[1] Perez, C. (2010). Technological revolutions and techno-economic paradigms. *Cambridge Journal of Economics, 34*(1), 185–202.
[2] Paraná, E. (2024). Platform studies and the finance-technology nexus: For a "genetic" approach. *Platforms & Society, 1*, 29768624241286779.
[3] Schilirò, D. (2025). Fintech, innovation ecosystems, and financial inclusion (MPRA Paper No. 127045).
[4] Han, Y., & Xu, X. H. (2024). Network empowerment and value co-creation of digital platform financial ecosystem —Based on the dynamic co-evolution logic of Ant Group. *Technology Economics, 43*(2), 79–91.
[5] Chen, M. A., Wu, Q., & Yang, B. (2019). How valuable is FinTech innovation? *The Review of Financial Studies, 32*(5), 2062–2106.
[6] Li, J. M., & Zhang, M. (2025). A study on the promoting role of fintech in the total factor productivity of enterprises in strategic emerging industries. *Journal of Risk Analysis and Crisis Response, 15*(4), 18.
[7] Zetzsche, D. A., Buckley, R. P., & Arner, D. W. (2021). Regulating Libra. *Oxford Journal of Legal Studies, 41*(1), 80–113.
[8] Wang, W., & Ni, H. (2025). Financial connectedness in the digital age: The impact of regional FinTech development. *Economic Modelling, 152*, 107290.
[9] Kumar, V., Nim, N., & Agarwal, A. (2021). Platform-based mobile payments adoption in emerging and developed countries. *Journal of International Business Studies, 52*(8), 1529–1558.
[10] Satyam, I., & Mehra, A. (2025). Fintech adoption and economic growth: Exploring the global landscape. *Journal of Credit Risk.*
[11] Jack, W., & Suri, T. (2011). Mobile money: The economics of M-PESA (NBER Working Paper No. 16721). National Bureau of Economic Research.
[12] Suri, T. (2017). Mobile money. *Annual Review of Economics, 9*, 497–520.
[13] Cong, L. W., Tang, K., Xie, D., & Zhao, W. (2024). FinTech platforms and asymmetric network effects: Theory and evidence from marketplace lending (NBER Working Paper No. w33173).
[14] Grand View Research. (2021). Embedded finance market size, share & trends analysis report, 2021-2028.
[15] Chew, B. C., Tan, L. H., Abdullah, N. L., & Hamid, S. R. (2025). Ant-financial in establishing the early stage of the Alipay eco system in Malaysia. *Qualitative Research in Financial Markets, 17*(4), 880–921.
[16] Al-Dahdah, E. (2020). South Africa digital economy assessment. World Bank.
[17] Cesar Leandro, J., & Botelho, D. (2022). Consumer over-indebtedness: A review and future research agenda. *Journal of Business Research, 145*.
[18] International Monetary Fund. (2025). Growing retail digital payments: The value of interoperability (Fintech Note No. 2025/004).