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A Literature Review of Digital Inclusive Finance: Status, Development and Prospects

Rui Zhang*

School of Economics and Management, Guangxi Normal University, Guilin 541000, Guangxi, China

Author to whom correspondence should be addressed.

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Abstract: China has positioned digital inclusive finance as a core component of the national development strategy, which serves as a key tool for serving the real economy, promoting social equity, and achieving common prosperity. This paper comprehensively and deeply reviews and summarizes the domestic and international literature based on the effective measurement of digital inclusive finance, its spillover effects on the real economy, and the underlying mechanisms, driving factors, and future outlook. It also looks forward to the key research directions in this field. By leveraging digital technologies such as big data and artificial intelligence, the paper aims to solve the predicaments of "long-tail customers" facing difficulties and high costs in financing under the traditional financial model, and promote a more extensive, fair, and efficient allocation of financial resources.

Keywords: Digital inclusive finance; Big data; Artificial intelligence; Literature research

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1. Introduction

Since the 21st century, the digital technology revolution, represented by the Internet, big data, and artificial intelligence, has swept across the globe, profoundly reshaping the formats and models of the traditional financial industry. Against this backdrop, inclusive finance—a concept aimed at providing effective and comprehensive financial services to all sectors and groups in society—has deeply integrated with digital technology, giving rise to the emerging field of digital inclusive finance [1]. By significantly reducing service costs, enhancing accessibility, and optimizing user experience, digital inclusive finance offers a revolutionary solution to the "last mile" problem faced by traditional inclusive finance, which stems from its reliance on physical branches and high operating costs [2]. It has thus become a major trend in global financial development.

The importance of digital inclusive finance has been widely recognized by the international community. In 2016, the G20 Hangzhou Summit approved the G20 High-Level Principles for Digital Financial Inclusion,

which systematically elaborated on the main objectives and action recommendations for the development of digital inclusive finance, marking its elevation from practical exploration to a global consensus.

In China, the development of digital inclusive finance is endowed with even more profound strategic significance. The successive introduction of a series of central policies, such as the "Plan for the Development of Inclusive Finance (2016–2020)" and the "Implementation Opinions on Promoting High-Quality Development of Inclusive Finance," as well as the Central Financial Work Conference's designation of both "inclusive finance" and "digital finance" as two of the "five key areas to be prioritized," all highlight its core position within China's economic and financial system.

Although digital inclusive finance has developed rapidly in practice and achieved remarkable accomplishments, for instance, China has firmly secured a leading global position in areas like digital payments and digital lending—theoretical and empirical research within academia is still undergoing continuous deepening and systematization [3]. While existing studies have extensively explored the positive impacts of digital inclusive finance on household entrepreneurship and resident consumption, most research has concentrated on evaluating its socio-economic effects [4–5]. There is a lack of systematic review and integration concerning its own measurement methods, internal driving factors for development, multi-dimensional spillover effects, and future challenges and evolutionary paths. Particularly in the Chinese context, the development of digital inclusive finance exhibits distinct characteristics of "regional convergence" coexisting with "spatial heterogeneity", as well as a dynamic pattern shift from a "supply push" phase to a "demand pull" phase, subsequently facing a "bottleneck phase" [1, 3]. These complex stylized facts urgently require summarization and analysis from a literature perspective.

In view of this, this paper aims to conduct a relatively comprehensive and in-depth literature review of relevant research in the field of digital inclusive finance, both domestically and internationally. This paper will first review the construction and evolution of scientific measurement systems for digital inclusive finance, focusing on the methodology and value of authoritative index compilation. Subsequently, it will systematically summarize the spillover effects of digital inclusive finance on the real economy and their underlying mechanisms. Next, it will analyze the core driving factors for its development. Finally, based on synthesizing existing research, it will offer prospects regarding potential risks, regulatory challenges, and future research directions for digital inclusive finance, hoping to provide useful references and insights for subsequent theoretical research innovation and policy practice optimization.

2. Effective measurement of digital inclusive finance development

Accurately measuring the development level of digital inclusive finance is fundamental for in-depth research on its impacts, driving factors, and development trends. As digital inclusive finance is a multi-dimensional concept, involving multiple aspects of financial services and the widespread application of digital technology in the financial sector, scholars and relevant institutions have constructed diverse measurement indicator systems and methods from different dimensions.

Internationally, some authoritative organizations and institutions initiated research on inclusive finance indicator systems relatively early, providing important references for measuring digital inclusive finance. In 2012, the World Bank, in partnership with the Bill & Melinda Gates Foundation, launched the Global Financial Inclusion Database (Global Findex Database), which contains 131 indicators across six categories:

bank accounts, savings, borrowing, emergency funds, remittances, and payments. This database, with its international comparability and continuous monitoring attributes, provides rich data support for inclusive finance research. However, the indicator design of this database still focuses on traditional financial service scenarios and has insufficient coverage of new service forms enabled by the integration of digital technology and finance, making it difficult to fully capture the development characteristics of digital inclusive finance. Subsequently, to further refine the inclusive finance measurement framework, the Global Partnership for Financial Inclusion (GPFI), established at the 2013 G20 Summit in St. Petersburg, Russia, constructed an inclusive finance indicator system comprising 19 indicators across three dimensions: accessibility, usage, and quality of financial services. Compared to the former, although the GPFI system added some indirect considerations related to digital services in the "usage" dimension, it still did not fundamentally break through the measurement scope of traditional finance. It lacked targeted indicator design for core dimensions unique to digital inclusive finance, such as the "degree of digitalization" and the "geographic penetration of coverage breadth." With the deep integration of digital technology and finance, the limitations of these early indicator systems centered on traditional finance have become increasingly apparent. They can neither capture the innovative advantages of digital inclusive finance in terms of service channels, service costs, and risk control, nor adapt to the realistic scenario where digital financial services penetrate down to "long-tail groups" like rural areas and small/micro enterprises. Therefore, measurement methods that are more aligned with the development characteristics of digital finance are urgently needed for supplementation and improvement.

Domestic research has achieved fruitful results in measuring digital inclusive finance. The Institute of Digital Finance at Peking University, in collaboration with Ant Group Research Institute, utilized massive micro-level data from Ant Financial to construct a comprehensive digital inclusive finance indicator system and compiled the "Peking University Digital Financial Inclusion Index of China." This index measures development across three dimensions: coverage breadth of digital finance, usage depth of digital finance, and degree of digitalization of inclusive finance, selecting 33 specific indicators [1]. The index has a long time span and strong horizontal and vertical comparability, providing a widely used data foundation for domestic digital inclusive finance research. Numerous scholars have used this index to delve into the impacts of digital inclusive finance on various aspects of the economy and society.

Some scholars attempt to construct their own indicator systems to measure the development level of digital inclusive finance. Some studies select indicators from dimensions such as the availability of financial services, usage, service quality, and the application level of digital technology, e.g., the number of customers covered by financial institutions' online services, the variety of online financial products, and indicators of the convenience and security of digital financial transactions. Regarding data sources, besides relying on microdata from large fintech companies, traditional financial survey data are also comprehensively used, such as data from the China Household Finance Survey (CHFS) and the China Rural Inclusive Finance Survey. However, self-constructed indicator systems may face issues such as incomplete indicator coverage, difficulty in data acquisition, and poor coordination between different data sources. For example, some regional financial service data may be difficult to collect comprehensively, leading to biases in measuring local digital inclusive finance development.

In terms of measurement methods, in addition to traditional statistical surveys and questionnaire methods, innovative approaches based on big data and machine learning have continuously emerged in

recent years. The Analytic Hierarchy Process (AHP) combined with Principal Component Analysis (PCA) is commonly used in index calculation. AHP can determine the weights of various indicators through methods such as expert scoring, reflecting the relative importance of different indicators within the digital inclusive finance system. PCA, on the other hand, can perform dimensionality reduction on multiple correlated indicators, extract principal components, avoid issues of multicollinearity among indicators, and make measurement results more scientific and objective. Furthermore, the entropy method is also used to determine indicator weights. This method objectively assigns weights based on the degree of dispersion of indicator data, reducing the interference of subjective factors. With technological advancements, some studies utilize satellite remote sensing technology to accurately measure the spatial distribution of financial service facilities, aiming to reflect the breadth of financial service coverage more comprehensively. Additionally, machine learning algorithms are employed to mine massive amounts of financial transaction data and analyze user financial behavior patterns, thereby enabling a more precise assessment of the usage depth of digital finance.

Examining the measurement results, numerous studies have revealed several characteristics of China's digital inclusive finance development. Overall, China's digital inclusive finance has developed rapidly, with the index showing a year-on-year upward trend, reflecting the widespread penetration of digital technology in the financial sector and the continuous improvement of inclusive financial service levels [1]. In terms of spatial distribution, it exhibits significant agglomeration and heterogeneity. The development level of digital inclusive finance in the eastern region is generally high, while it lags in the central and western regions. However, in recent years, the regional disparity has shown a trend of gradual narrowing. The development of digital inclusive finance at the county level has also made significant progress, but a gap remains compared to cities, requiring further improvement in the degree of digitalization and depth of usage of financial services (China County Digital Inclusive Finance Development Index Research Report, 2024).

Overall, current research on measuring digital inclusive finance is continuously improving and innovating in terms of indicator system construction and measurement method application. However, some challenges remain. Results from different indicator systems and measurement methods may differ, lacking unified standards and norms. Data acquisition and quality control for some data are difficult, especially financial service data concerning vulnerable groups like small or micro enterprises and rural areas. In terms of dynamically monitoring new trends and characteristics of digital inclusive finance development, existing measurement systems need further optimization and updating to better adapt to the reality of rapid innovation and development in digital finance.

3. Spillover effects of digital inclusive finance

3.1. Enterprise level

The spillover effect of digital inclusive finance on the real economy is first manifested in optimizing investment and financing structures and alleviating financing constraints. Wang and Ma point out that digital inclusive finance can positively moderate the inhibitory effect of ESG performance on corporate "short-term borrowing for long-term investment" by reducing information asymmetry and intensifying competition among banks, prompting financial institutions to provide more long-term financial support, thereby reducing corporate financial risks [6]. Moreover, this financing optimization effect is particularly pronounced in the

manufacturing sector. Guan et al. further confirm that digital inclusive finance can further alleviate financing constraints for manufacturing enterprises through technology spillover effects, providing crucial financial guarantees for production equipment upgrades and capacity expansion [7]. Furthermore, the spillover effects of digital inclusive finance on enterprises of different sizes exhibit differentiated adaptation characteristics: Zhang et al. find that it provides "timely assistance" support for the exports of small and micro enterprises, helping them overcome cross-border financing and settlement bottlenecks [8]. In contrast, Wang et al. show that the value enhancement path of digital inclusive finance for technology-based SMEs differs, primarily achieved by reducing innovation financing costs and promoting technological achievement transformation [9]. Building on this, Xiang et al. and Du et al. further supplement relevant research conclusions [10–11]. Xiang Dong confirms that digital inclusive finance can alleviate financing constraints for small, medium, and micro enterprises, thereby promoting R&D investment and patent output. Du Jinzhu emphasizes its role in promoting enterprises to achieve a dual balance between "exploratory innovation" and "exploitative innovation" by improving financing efficiency. Besides optimizing financing and innovation support, from another perspective, digital inclusive finance can also positively regulate the allocation of enterprise production factors: Kuang et al. find that it can promote enterprises to expand production scale by alleviating financing constraints, thereby driving increased labor demand, and this effect is more significant in labor-intensive enterprises [12]. Chen also mentions that digital inclusive finance can enhance corporate governance transparency, reduce managerial agency problems, and make corporate M&A decisions more aligned with long-term strategies, effectively avoiding irrational investment behavior [13]. Overall, the mechanisms underlying these effects all revolve around the core logic of "digital technology empowering financial services": quantifying corporate "soft information" through big data technology to reduce financial institutions' risk assessment costs, promoting the deep integration of financial services with enterprise production processes through technology spillover effects, and ultimately helping enterprises optimize resource allocation and achieve sustainable development.

3.2. Rural economic sector

The spillover effect of digital inclusive finance takes "scene embedding" as its core starting point. Luo et al. find that rural e-commerce can significantly enhance the coverage breadth, usage depth, and digitalization level of county-level digital inclusive finance [14]. This synergistic effect further extends to the transformation of the rural economy. From the perspective of agricultural production efficiency, digital inclusive finance can significantly improve county-level agricultural total factor productivity, with a stronger effect in eastern counties. It achieves this by optimizing agricultural capital allocation, promoting the adoption of smart agricultural technologies, and reducing production waste. Huang et al. further find that it can lower entrepreneurial thresholds and risks, facilitating the establishment of new agricultural business entities such as family farms and farmer cooperatives, thereby laying the foundation for large-scale and intensive agricultural development [15].

3.3. Farmers' and rural common prosperity level

Fu and Huang, based on the China Household Finance Survey, found that digital inclusive finance reduces rural households' demand for productive formal credit while increasing their demand for consumer formal credit [18]. This effect is more significant among groups who use smartphones, have online shopping habits,

and have higher education levels. The mechanism behind this effect lies in digital payment and credit tools enhancing consumption convenience while alleviating liquidity constraints, enabling residents to meet long-term consumption needs such as education and healthcare. This consumption-level spillover is also reflected in enhanced risk-coping abilities. Yi and Zhou show that the promotional effect of digital inclusive finance on household consumption is stronger among rural residents and middle-to-low-income groups [5]. Zhang and Huang further point out that digital inclusive finance can help rural residents maintain basic consumption during economic fluctuations through convenient credit tools, enhancing consumption resilience [17]. Wang et al. verify the "consumption risk smoothing" effect of digital inclusive finance, dispersing the impact of income volatility on consumption through tools such as insurance and credit [18]. Beyond consumption, digital inclusive finance can also optimize household asset allocation and promote employment. Pang and Wang find that digital inclusive finance improves residents' financial literacy through online financial knowledge dissemination, guiding households to increase holdings of diversified financial assets such as money market funds and insurance, thereby reducing reliance on savings [19]. Guo et al. confirm that digital inclusive finance promotes non-farm employment by supporting rural entrepreneurship and providing employment information matching, increasing the share of non-farm income among rural residents by 5.2% and narrowing the urban-rural income gap [20]. However, it should be noted that its spillover effects are not entirely positive. Lei et al. find that the development of digital inclusive finance is accompanied by an increased risk of internet fraud among rural elderly with low digital literacy, primarily due to the digital divide formed by the complexity of digital technology and the elderly's insufficient digital operation and information discrimination abilities, with fraudsters exploiting the online characteristics to lower identification difficulty [21]. This also suggests the need to mitigate negative effects through digital literacy education.

3.4. Regional synergy and common prosperity perspective

The spatial spillover effect of digital inclusive finance injects momentum into regional innovation. Zhang et al. point out that the combination of digital inclusive finance and the digital economy can promote "inclusive growth," making the innovation growth rate in less developed regions higher than in developed ones and alleviating regional development imbalances [4]. Regarding the specific pathways to common prosperity, human capital enhancement and the alleviation of liquidity constraints are two core mechanisms. Zhang et al., from a human capital perspective, find that digital inclusive finance can enhance rural residents' investment in education and skills, boosting their income growth rate by 3.6% and granting them long-term income-increasing capacity [23]. From a regional practice perspective, Gao et al., using the Yangtze River Economic Belt as an example, verify its "gradual" promoting effect: first promoting rural industrial development by alleviating financing constraints, then driving consumption upgrading through income growth, forming a gradual advancement pattern [24].

3.5. Poverty alleviation level

In the research on pathways for digital inclusive finance to serve common prosperity, Jin et al. first empirically demonstrate the significant efficiency of digital inclusive finance in alleviating relative poverty, providing foundational evidence for its value in the livelihood sector [25]. Building on this, Wang et al. delve deeper into the mechanism, emphasizing that digital inclusive finance can unleash the development potential of low-income groups—such as entrepreneurship and skills training—by alleviating their liquidity constraints [26]. Together, these studies form a complementary progression from "effect verification" to "mechanism decomposition," collectively

constituting the core pathway for digital inclusive finance to serve common prosperity. Furthermore, the spillover effects of digital inclusive finance on the real economy can be further strengthened through cross-sectoral synergy. Luo et al. point out that the construction of the data element market can provide new support for digital inclusive finance to empower the real economy by enhancing innovation capacity and promoting talent aggregation, and this strengthening effect is more pronounced in regions with good digital infrastructure but low marketization levels [27]. This finding also opens a new direction for the synergistic service of digital inclusive finance and green finance to the real economy. Meanwhile, research by Xie et al. supplements relevant conclusions from a micro-entity perspective, confirming that digital inclusive finance can effectively promote entrepreneurial activities by compensating for the insufficient coverage of traditional finance and reducing the risk assessment costs for small and micro enterprises [28]. Moreover, this promoting effect is more prominent in areas with low urbanization rates and among micro-enterprises, further enriching the spillover dimensions of digital inclusive finance towards micro-entities in the real economy and echoing Luo et al.'s macro-synergy perspective [27].

Overall, the spillover effects of digital inclusive finance on the real economy exhibit characteristics of being "multi-dimensional, differentiated, and synergistic." Its mechanisms consistently revolve around the empowerment of financial services through digital technology. In the future, there is a need to further strengthen scenario synergy and risk prevention to maximize its positive effects.

4. Driving factors of digital inclusive finance

4.1. Technology empowerment

The iteration of digital technology serves as the underlying support for the development of digital inclusive finance. Its core value lies in breaking the traditional financial industry's dependence on physical branches, lowering service thresholds, and reducing operating costs. Guo Feng et al., in "Measuring the Development of Digital Inclusive Finance in China: Index Compilation and Spatial Characteristics," point out that digital finance, relying on intelligent algorithms, big data, and cloud computing technologies, achieves "geographic penetration" of financial services [1]. Even in remote areas lacking bank branches, residents can access services like payments and credit through computers and mobile terminals. This technological characteristic boosted the coverage breadth of digital inclusive finance from a provincial average of 34.71 in 2011 to 122.04 in 2018, with an average annual growth rate exceeding 30%. Xie et al. further verify that digital technology quantifies the "soft information" of small and micro enterprises, reducing risk assessment costs by over 40% [28]. This enables micro-enterprises previously excluded due to insufficient hard information to obtain credit support, which also explains why the credit business weight accounts for 38.3% in the usage depth index of digital inclusive finance [1].

4.2. Scene embedding

Digital inclusive finance does not exist in isolation; rather, it is deeply embedded in real economic scenarios, using data accumulated from these scenarios to resolve information asymmetry. Luo et al. found that rural e-commerce scenarios record user browsing and transaction data through "non-financial accounts" [27]. Financial institutions use this data to build credit assessment models, demonstrating the significant promotional effect of digital inclusive finance on the county-level digital financial inclusion index, coverage breadth, and usage depth. The synergy between e-commerce and digital finance not only reduces the circulation costs of

agricultural products but also shifts financial services from "passive response" to "active push." For example, farmers' e-commerce sales data can be used to anticipate their production fund needs in advance and match them with credit products. This scenario-based service increases the probability of rural consumer credit demand by 0.1% [16].

4.3. Data elements

The market-oriented allocation of data elements provides new growth momentum for digital inclusive finance, particularly in addressing the issue of "data silos." Luo et al. indicate that the establishment of data trading platforms has increased the coupling coordination degree between digital inclusive finance and green finance by 0.0064 units [14]. The core mechanism lies in these platforms integrating green information scattered across governments and enterprises, helping financial institutions accurately identify green inclusive projects, thereby alleviating the dilemma of "green finance not being inclusive and digital inclusive finance not being green." This data-driven logic is also reflected at the micro level. For instance, Huang et al. found that credit assessments based on agricultural production data increase the probability of establishing new agricultural business entities by 12%, confirming the optimizing effect of data elements on the efficiency of financial resource allocation [15].

4.4. Policy guidance and demand pull

At the policy level, Zhang et al. point out that policies such as the 2015 "Plan for the Development of Inclusive Finance (2016–2020)" guided digital financial resources towards agriculture, rural areas, and farmers, as well as small and micro enterprises through fiscal subsidies and differentiated regulation [4]. This contributed to the convergence coefficient for digital inclusive finance in the central and western regions decreasing from 0.44 in 2011 to 0.09 in 2018 [1]. At the demand level, Fu et al., based on the China Household Finance Survey, found that rural residents' demand for consumer credit significantly increased with the development of digital inclusive finance, while demand for productive credit decreased. This change in demand structure compelled digital inclusive financial services to shift from a "production-oriented" approach to one that "emphasizes both consumption and production" [16]. Zhang and Huang mention that in response to fluctuations in rural consumption, digital inclusive finance introduced credit products with "flexible repayment" options, significantly enhancing consumption resilience [17].

4.5. Inclusive attribute

The core competitiveness of digital inclusive finance lies in its "inclusive attribute," i.e., precisely serving groups traditionally difficult for traditional finance to cover. Zhang et al. found that digital inclusive finance, by reducing financing constraints for education and skills training, enhances the human capital level of rural residents, thereby narrowing the urban-rural income gap [23]. Guo et al. further add that this inclusivity is also evident in the employment sector [20]. Rural entrepreneurship projects supported by digital inclusive finance increase the share of non-farm employment by 5.2%, with a more significant effect on low-skilled groups.

5. Prospective forecasts for digital inclusive finance

5.1. Potential risks

While digital inclusive finance broadens service boundaries and empowers the real economy, potential risks

are gradually emerging as its penetration depth and coverage breadth expand, exhibiting characteristics of multi-dimensional and cross-scenario transmission. From a group perspective, the risk differentiation caused by the digital divide continues to intensify. Lei et al. found that rural elderly with low digital literacy face an 18-percentage-point higher probability of encountering internet fraud compared to urban elderly, due to insufficient digital operation skills and weak information discrimination abilities [21]. Fu et al. further point out that rural groups with lower education levels and no online shopping habits not only struggle to effectively utilize digital inclusive finance services for credit support but may instead fall into "passive exclusion" due to information asymmetry, exacerbating the urban-rural and inter-group imbalances in financial resource allocation [16]. From a data perspective, data security and ownership disputes constitute core risks and hidden dangers. Luo et al., based on a quasi-natural experiment involving data trading platforms, found that although the construction of data element markets can promote the integration of digital inclusive finance and green finance, issues such as data fraud and privacy leaks persist during the process of breaking "data silos" [14]. Moreover, vaguely defined data ownership may lead to disputes between financial institutions and data providers, which then transmit through the inclusive finance service chain, affecting credit availability for core service targets such as new agricultural business entities and small/micro enterprises. Research at the county level by Huang et al. also verifies that data quality defects can reduce the probability of new agricultural business entities obtaining credit approval by 12% [15]. From an enterprise perspective, the risk of "algorithmic discrimination" triggered by technological dependence cannot be ignored. Although Wang et al. confirm that digital inclusive finance can alleviate corporate investment and financing maturity mismatches, over-reliance on digital technology for constructing risk assessment models may lead to credit exclusion for small/micro enterprises with "mismatched data characteristics" but potential for development, inadvertently exacerbating their financial risks and operational volatility [6].

5.2. Regulatory challenges

The innovative attributes and cross-sectoral characteristics of digital inclusive finance present its regulatory system with three core challenges: "lag," "coordination difficulty," and "adaptability." Traditional regulatory frameworks struggle to fully adapt to its development needs. First, regulatory policies lag behind the pace of innovation. Huang et al. point out that the integration of digital inclusive finance with green finance and data elements has spawned new products like green inclusive credit and data pledge financing [2, 14]. However, existing regulatory rules still center on traditional financial businesses, lacking specific standards for cross-sectoral integrated businesses. This leaves some innovative operations in a "regulatory gray area," potentially stifling innovation or allowing risks to accumulate due to regulatory gaps. Second, cross-regional and cross-departmental regulatory coordination is challenging. Regulatory measures in one region may transmit effects to surrounding areas, but current local regulatory standards are inconsistent, and cross-regional information-sharing mechanisms are imperfect, hindering the formation of a cohesive regulatory force. Simultaneously, digital inclusive finance involves multiple fields such as finance, data, agriculture, and e-commerce, requiring multi-departmental coordinated regulation [22, 27]. However, different departments have varying regulatory objectives—for example, financial regulation focuses on risk control, data regulation on privacy protection, and agricultural regulation on industrial support—which may lead to regulatory conflicts and reduce efficiency. Finally, regulation struggles to adapt to heterogeneous service scenarios. Digital inclusive finance serves diverse targets, including small and micro enterprises and new agricultural business entities [8, 22]. The

risk characteristics and service needs differ significantly across scenarios. Uniform regulatory standards may inhibit scenario-based innovation, while excessive differentiated regulation increases costs, creating a "regulatory dilemma."

5.3. Research directions

Future research on digital inclusive finance can focus on three dimensions: "deepening mechanism research," "expanding heterogeneity research," and "quantifying synergy effects." This aims to address the shortcomings of existing studies and provide more precise theoretical support for practice. First, mechanism research needs to further refine the transmission pathways. Existing literature has confirmed that human capital and data elements are key mediators in the impact of digital inclusive finance on common prosperity and green integration [14, 23]. However, detailed discussions on the mechanisms remain insufficient. Future research could delve into the marginal effect differences of various human capital types in how digital inclusive finance narrows the urban-rural income gap, or the differentiated impacts of different stages of data element marketization on the integration of digital inclusive finance and green finance, to more clearly reveal the logic of action. Second, heterogeneity research could extend towards adaptation strategies for micro-entities and regional strategies. Existing research mostly focuses on provincial or county levels [1, 24]. Future research could further explore the differential impacts of digital inclusive finance on various micro-entity types—such as family farms versus farmer cooperatives, labor-intensive versus technology-intensive small and micro enterprises—or analyze adaptation pathways for digital inclusive finance in conjunction with regional strategies like rural revitalization and the integrated development of the Yangtze River Delta [8, 22]. It could also build on Guo et al.'s research to conduct an in-depth exploration of the impact of digital inclusive finance on the quality of non-farm employment for workers with different skill levels, thereby enriching heterogeneity findings. Finally, synergy effect research could extend to multiple fields and quantify contribution degrees [20]. Luo et al. have explored the integration of digital inclusive finance and green finance [14]. Future research could further investigate its synergistic mechanisms with technology finance and pension finance, or how to promote the inclusiveness of pension finance through age-friendly services [21]. Simultaneously, building on Zhang et al.'s inclusive growth framework, it could quantify the contribution of synergy between digital inclusive finance and other fields to common prosperity, providing more precise empirical evidence for policymaking [4].

6. Conclusion

This paper focuses on four core issues—the effective measurement, spillover effects, driving factors, and forward-looking prospects of digital inclusive finance—and provides a systematic review and assessment of domestic and international literature. Overall, the measurement system for digital inclusive finance has gradually become independent of and matured beyond the traditional financial framework. Domestic practices represented by the Peking University Digital Financial Inclusion Index have laid a solid data foundation for empirical research; however, early international frameworks insufficiently cover digital service forms, and self-constructed indicator systems in China face difficulties in data coordination. Consistency and dynamism thus remain bottlenecks that urgently need to be addressed. The spillover effects of digital inclusive finance on the real economy are characterized by multidimensionality, differentiation, and synergy, and their core mechanism consistently revolves around digital technology empowering financial services. Digital

inclusive finance exhibits significant positive effects in corporate financing and innovation, rural economic transformation, household consumption resilience, and regional inclusive growth. Nevertheless, the increased fraud risk encountered by rural groups with low digital literacy and the "algorithmic discrimination" potentially induced by technological dependence also suggest that the realization of positive effects must be premised on risk prevention and control. The development of digital inclusive finance is the result of the synergistic driving of multiple factors, including technological empowerment, scenario embedding, data elements, policy guidance, and its inclusive nature. These factors resonate through the core logic of "digital technology empowering financial services," jointly promoting the in-depth development of digital inclusive finance. In the future, a dynamic balance must be sought between innovation and security, and between efficiency and equity, with sustained efforts focused on three dimensions: deepening mechanisms, expanding heterogeneity, and quantifying synergistic effects. Moreover, by pursuing consistency between scientific rigor and dynamism in measurement systems, balancing positive spillovers and negative risks in effect evaluation, and adapting regulatory frameworks to both innovation incentives and risk prevention and control, it will be possible to promote digital inclusive finance to achieve steady and sustained progress along the track of high-quality development and to truly realize a broader, fairer, and more efficient allocation of financial resources.

Disclosure statement

The author declares no conflict of interest.

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