Scientific and Social Research, 2026, Volume 8, Issue 1
https://ojs.bbwpublisher.com/index.php/SSR
Online ISSN: 2981-9946
Print ISSN: 2661-4332

Research on the Realization Mechanism of Digital Technology Empowering Rural Common Prosperity

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Abstract: Digital technology, as a core carrier of new-quality productive forces, has become a key engine for promoting rural revitalization and achieving common prosperity. Based on the perspective of the Marxist technical view and the practical requirements of rural common prosperity in China, this paper systematically analyzes the internal mechanism, practical dilemmas, and realization paths of digital technology empowering rural common prosperity. The study finds that digital technology empowers rural common prosperity through three mechanisms: optimizing resource allocation, promoting industrial upgrading, and innovating governance models. However, in the practical process, it faces multiple dilemmas such as inadequate digital infrastructure, insufficient talent supply, poor technology adaptation, and uneven benefit distribution. To address these problems, this paper proposes a targeted path system: consolidating digital infrastructure, improving talent cultivation systems, promoting technology-scenario adaptation, and improving benefit linkage mechanisms. This study provides theoretical support and practical reference for digital technology to better empower rural common prosperity.

Keywords: Digital technology; Rural common prosperity; Empowerment mechanism; Practical dilemmas; Realization paths

Online publication: January 30, 2026

1. Introduction

Chinese modernization is the modernization of common prosperity for all people, and the most arduous and onerous task of promoting common prosperity lies in rural areas. The report of the 20th National Congress of the Communist Party of China clearly proposed to “comprehensively promote rural revitalization” and “solidly promote common prosperity”, closely linking rural development with the common prosperity strategy, pointing out the direction for rural construction in the new era [1–2]. With the in-depth penetration of the digital economy into all fields of the economy and society, digital technology, as a new production factor, is profoundly transforming

traditional production methods and development models, injecting new momentum into rural common prosperity. The process of digital technology empowering rural common prosperity is essentially a process of the dialectical unity of technical instrumental rationality and value rationality. It is necessary to give full play to the instrumental advantages of digital technology in optimizing resource allocation and improving production efficiency, and adhere to the people-centered value orientation to ensure that the dividends of digital development are shared by all farmers.

In recent years, China's digital rural construction has accelerated comprehensively. Digital technology has been increasingly widely used in agricultural production, rural e-commerce, and rural governance. A development pattern has initially taken shape where mobile phones have become "new farming tools", data has become "new agricultural materials", and live-streaming with goods has become "new farming activities". However, at the same time, in the process of digital technology empowering rural common prosperity, a series of deep-seated contradictions and problems have been exposed, such as the persistence of the digital divide, low digital literacy of farmers, a mismatch between technology application and actual rural needs, and imperfect benefit distribution mechanisms. These problems have severely restricted the effective transformation of digital dividends into the achievements of rural common prosperity.

Existing studies have mostly focused on the application scenarios of digital technology in rural areas and the superficial paths of technology empowerment, but there is still a need to deepen research on the internal mechanism, the deep-seated causes of practical dilemmas, and the systematic realization paths of digital technology empowering rural common prosperity. Based on this, this paper systematically sorts out the internal mechanism of digital technology empowering rural common prosperity, deeply analyzes its practical dilemmas and causes, and then constructs a systematic realization path, providing new theoretical ideas and practical plans for promoting rural common prosperity.

2. The internal mechanism of digital technology empowering rural common prosperity

The empowerment of rural common prosperity by digital technology is a process of the dialectical unity of technological progress and social development. Its internal mechanism is reflected in three levels: the improvement of productive forces, the transformation of production relations, and the reshaping of the development pattern, which is highly consistent with Marxist theory on the dialectical relationship between productive forces and production relations, and between economic base and superstructure.

2.1. Optimizing the allocation of production factors to activate the endogenous dynamics of rural development

Marxist productive forces theory holds that productive forces are the ultimate decisive force promoting social development, and technological progress is the core driving force for the development of productive forces [3]. Digital technology optimizes the three elements of productive forces: laborers, means of labor, and objects of labor, comprehensively activating the endogenous dynamics of rural development.

In terms of laborers, digital technology improves farmers' production skills and management capabilities through skills training and knowledge popularization, promoting the transformation of traditional farmers into new professional farmers and realizing the modernization of human capabilities. Relevant studies have shown that farmers who receive systematic digital skills training have an average income increase of 23% compared

with those who do not receive training, and their ability to resist market risks is significantly enhanced [4]. In terms of means of labor, the deep integration of the Internet of Things, big data, artificial intelligence and other technologies with agricultural production has spawned new production tools such as intelligent agricultural machinery, precision irrigation, and intelligent monitoring of diseases and insect pests, transforming agricultural production from "relying on the weather" to "making decisions based on understanding the weather", which has greatly improved agricultural production efficiency and quality. In terms of objects of labor, digital technology realizes the maximization of resource utilization efficiency through the digital management and precise allocation of land, water resources, agricultural products, and other resources, promoting agricultural production to develop in the direction of refinement, intensification, and high efficiency.

2.2. Promoting industrial upgrading to reshape the rural economic development pattern

Digital technology breaks through the limitations of traditional rural industries and promotes the integrated development of rural primary, secondary, and tertiary industries, reshaping the rural economic development pattern [5]. Firstly, digital technology promotes the digital transformation of agriculture. Through the application of technologies such as satellite remote sensing, soil sensors, and crop growth monitoring systems, it realizes precise sowing, fertilization, and irrigation, improving agricultural production efficiency and product quality. Secondly, digital technology promotes the integrated development of rural industries. Relying on digital platforms, it connects agriculture with e-commerce, cultural tourism, health care, and other industries, developing new formats such as rural e-commerce, digital cultural tourism, and live-streaming with agricultural products, extending the industrial chain, and increasing added value. For example, rural e-commerce has effectively solved the problem of difficult sales of agricultural products, enabling farmers to directly connect with the market and obtain more value-added benefits. Thirdly, digital technology promotes the clustering development of rural industries. With digital technology as the support, it cultivates digital industrial clusters in rural areas, promotes the coordinated development of small farmers, cooperatives, and enterprises, forming scale effects and cluster advantages.

2.3. Innovating rural governance models to improve the modernization level of rural governance

Digital technology provides a new technical path for innovating rural governance models and improving the modernization level of rural governance. Firstly, digital technology promotes the precision of rural governance. Through the construction of digital governance platforms, it realizes the collection, analysis, and application of rural governance data, providing precise support for rural governance decisions. For example, the application of digital technology in rural public security management can realize real-time monitoring and early warning of public security incidents, improving the efficiency of public security governance. Secondly, digital technology promotes the democratization of rural governance. Through digital platforms such as WeChat groups and rural governance apps, it broadens the channels for farmers to participate in governance, ensures farmers' right to know, participate, and make decisions, and enhances farmers' sense of gain, happiness, and security. Thirdly, digital technology promotes the equalization of rural public services. Through digital education, digital medical care, and other means, it enables rural residents to enjoy the same level of public services as urban residents, narrowing the development gap between urban and rural areas.

3. The dilemmas of digital technology empowering rural common prosperity

Although digital technology provides strong technical support for rural common prosperity, in the process of practical promotion, due to multiple constraints such as the rural development foundation, technology application environment, and institutional guarantee system, the empowerment efficiency of digital technology has not been fully released, facing multiple practical dilemmas.

3.1. Weak digital infrastructure: The "hard bottleneck" of digital empowerment

Digital infrastructure is the prerequisite for the application of digital technology, but there are still obvious shortcomings in the construction of rural digital infrastructure. In terms of network coverage, although China has achieved "broadband access to every village" in administrative villages, remote mountainous areas still have problems such as unstable signals, slow broadband speed, and insufficient computing power, and there are even network blind spots in some areas, which cannot meet the network needs of new formats such as smart agriculture and rural e-commerce. In terms of hardware configuration, the popularization rate of smart terminals, Internet of Things equipment, and other hardware facilities in rural areas is low, and the purchase cost of equipment is high, which ordinary farmers cannot afford, restricting the application of digital technology in agricultural production and life services. In terms of data support, the construction of infrastructure for data collection, storage, and analysis in rural areas is lagging behind, and agricultural-related data is scattered across different departments and subjects, resulting in a serious "data island" phenomenon, which makes it difficult to form a joint force of data to support rural development decisions.

3.2. Insufficient talent supply: The "soft constraint" of technology implementation

Talents are the core support for digital technology to empower rural common prosperity, but the problem of talent shortage in rural areas is prominent, becoming a "soft constraint" restricting the implementation of digital technology. Firstly, the digital literacy of the local labor force is low [6]. The labor force left behind in rural areas is mostly older and less educated, with weak digital skills and literacy, insufficient awareness and acceptance of digital technology, and difficulty in proficiently using digital tools to carry out production and operation. For example, the participation rate of intelligent agricultural machinery operation training is less than 30%. Secondly, it is difficult to attract and retain compound talents [7]. Rural areas have relatively backward economic conditions and insufficient high-quality living supporting facilities, making it difficult to attract compound talents who understand both agriculture and technology. At the same time, a large number of young and middle-aged labor forces and high-quality talents in rural areas have flowed out, resulting in a shortage of local digital "leaders" and a lack of core support for the promotion and application of digital technology. Thirdly, the talent training system is imperfect. Digital skills training for farmers lacks systematicness and pertinence, and the training content is out of touch with the actual needs of rural production and life, making it difficult to effectively improve farmers' digital application capabilities and form a virtuous cycle of "training-application-income increase."

3.3. Poor technology adaptation: The "blocking point" of supply-demand mismatch

The value realization of digital technology must be adapted to the actual needs of rural areas, but there is an obvious mismatch between the supply of digital technology and the actual needs of rural areas, becoming a "blocking point" restricting the effect of digital empowerment. Firstly, the technical scenarios have poor adaptability. Mature intelligent algorithms and digital technologies in cities are difficult to adapt to the complex

and changeable natural conditions and decentralized production models in rural areas. Some equipment is complicated to operate, making farmers discouraged. At the same time, existing digital technologies mostly serve large-scale agricultural operations, and the supply of lightweight and low-cost digital tools suitable for small farmers is seriously insufficient. Secondly, the technology supply is "one-size-fits-all". When promoting digital rural construction, some local governments ignore regional industrial characteristics and farmers' actual needs, blindly introducing digital technologies and equipment, resulting in idle intelligent equipment and a low utilization rate of digital systems, forming a situation of "construction without use." Thirdly, the value release of data elements is insufficient. A large amount of agricultural-related data is precipitated in different departments and enterprises, and there is a serious "data island" phenomenon, lacking a unified sharing and circulation mechanism, which cannot realize data integration and value mining, and is difficult to transform into productive forces and governance efficiency to promote rural development.

3.4. Uneven benefit distribution: The "obstruction point" of shared prosperity

The core of common prosperity is the fair sharing of development achievements, but in the process of digital technology empowering rural development, the problem of uneven benefit distribution is prominent, becoming an "obstruction point" restricting shared prosperity. Firstly, farmers have low participation and voice. In the process of digital technology application, farmers are often in a passive acceptance position, lacking the right to speak and decision-making power in technology application and industrial development, and it is difficult to fully share the value-added benefits brought by digital technology. Secondly, the benefit linkage mechanism is imperfect. The benefit distribution of new formats such as rural e-commerce and agricultural product processing is mostly concentrated in intermediate links such as platform enterprises and dealers, and the proportion of benefits obtained by farmers is low. It is impossible to form a close benefit linkage mechanism of "enterprises + cooperatives + farmers" or "e-commerce platforms + farmers", and it is impossible to realize risk sharing and benefit sharing. Thirdly, vulnerable groups are marginalized. The "digital divide" between urban and rural areas and between different groups in rural areas still exists. Vulnerable groups, such as the elderly and low-income groups, have difficulty enjoying the dividends brought by digital technology, and may even further widen the development gap with other groups due to digital transformation, violating the fairness principle of common prosperity.

4. The paths of digital technology empowering rural common prosperity

To solve the practical dilemmas of digital technology empowering rural common prosperity, people must adhere to the core position of Marxist technical view, adhere to the people-centered value orientation, and build a systematic realization path from four dimensions: consolidating digital infrastructure, improving talent cultivation systems, promoting technology-scenario adaptation, and improving benefit linkage mechanisms, so as to promote the deep integration of digital technology and rural development.

4.1. Consolidate digital infrastructure to lay a solid hardware foundation for digital empowerment

Infrastructure is the premise for the application of digital technology. People must accelerate the improvement of the shortcomings of rural digital infrastructure to lay a solid hardware foundation for digital technology to empower rural common prosperity. Firstly, optimize the quality of network coverage. Increase investment in network construction in remote mountainous areas and underdeveloped areas, promote the extension of 5G

networks and gigabit optical fibers to rural areas, improve network speed and stability, eliminate network blind spots, and ensure that rural areas can meet the network needs of new formats such as smart agriculture and rural e-commerce. Secondly, improve the infrastructure operation and maintenance system. Establish a digital infrastructure operation and maintenance mechanism led by the government, participated by the market, and benefited by farmers, clarify the main responsibility of operation and maintenance, guarantee the investment of operation and maintenance funds, and promote the standardization of agricultural-related data to break "data islands" and realize the interconnection and data sharing of various information systems [8]. Thirdly, promote the popularization of hardware facilities. Increase policy support and financial subsidies for rural digital hardware facilities, encourage enterprises to develop smart terminals and Internet of Things equipment suitable for rural scenarios, simple to operate and low in price, improve the popularization rate of digital hardware facilities, and enable more farmers to use digital technology conveniently.

4.2. Improve talent cultivation systems to strengthen talent support for digital empowerment

Talents are the core elements of digital technology, empowering rural common prosperity. People must improve the rural digital talent cultivation system to provide solid talent support for digital empowerment. Firstly, improve the digital literacy of local farmers. According to the actual needs of rural labor forces, carry out systematic and targeted digital skills training, covering intelligent agricultural machinery operation, rural e-commerce operation, live-streaming with goods, etc., adopt a combination of online and offline training methods to improve the effectiveness of training, and promote the transformation of traditional farmers into new professional farmers. Secondly, increase the introduction of talents.

Formulate preferential policies to attract college graduates, returned entrepreneurial youth, urban technical talents, etc. to participate in rural construction, providing talent support for the application of digital technology in rural areas; at the same time, improve the incentive mechanism for rural talents, improve the treatment level and development space of rural talents, so that talents can stay and play their roles. Thirdly, cultivate local digital leaders. Select a group of rural backbones with culture, technology, and management capabilities for key training, making them leaders in the promotion and application of digital technology, giving play to their demonstration and leading roles, and driving more farmers to participate in digital technology application.

4.3. Promote technology-scenario adaptation to improve the actual effect of digital empowerment

The value realization of digital technology must match the actual needs of rural areas. People must promote the deep integration of digital technology with rural production and life scenarios to improve the actual effect of digital empowerment. Firstly, develop digital technologies suitable for rural areas. Encourage enterprises to conduct in-depth investigations in rural areas, develop lightweight, low-cost, and easy-to-operate digital technologies and tools according to the complex natural conditions, decentralized production models, and diversified needs in rural areas, to meet the different needs of small farmers and new agricultural business entities. Secondly, promote the deep integration of digital technology and industries. Based on the characteristics of rural industries, promote the deep integration of digital technology with agricultural production, rural e-commerce, rural tourism, and other industries, build a number of digital agricultural demonstration bases, rural e-commerce demonstration villages, etc., form replicable and promotable experience models, and promote the transformation and upgrading of rural

industries. Thirdly, strengthen the value mining of data elements. Establish and improve the sharing and circulation mechanism of agricultural-related data, break the data barriers between departments and enterprises, promote the integration and analysis of agricultural-related data, transform data resources into productive forces to promote rural development, and provide precise support for agricultural production and rural governance.

4.4. Improve benefit linkage mechanisms to realize the fair sharing of development achievements

The core of common prosperity is the fair sharing of development achievements. People must improve the benefit linkage mechanism of digital technology, empowering rural development, to ensure that digital dividends can be shared by all farmers. Firstly, improve farmers' participation and voice. Establish and improve the decision-making mechanism for farmers to participate in digital technology application and industrial development, guarantee farmers' right to know, participate, and make decisions, so that farmers can actively participate in the process of digital technology empowering rural development. Secondly, build a close benefit linkage mechanism. Promote the development of models such as "enterprises + cooperatives + farmers" and "digital platforms + farmers", establish a fair and reasonable benefit distribution mechanism, clarify the rights and obligations of all parties, enable farmers to share more value-added benefits brought by digital technology, and realize risk sharing and benefit sharing. Thirdly, pay attention to the development needs of vulnerable groups [9]. For vulnerable groups such as the elderly and low-income groups, formulate special support policies, carry out targeted digital skills training, provide aging-friendly and low-cost digital services, help them cross the digital divide, share the development dividends brought by digital technology, and ensure that no one is left behind on the road to common prosperity.

5. Conclusion and prospect

Digital technology, as a core carrier of new-quality productive forces, provides strong technical support and practical possibilities for solving rural development bottlenecks and promoting rural common prosperity. From the perspective of the Marxist technical view, the process of digital technology empowering rural common prosperity is essentially a process of the dialectical unity of technical instrumental rationality and value rationality. It is necessary to give full play to the instrumental advantages of digital technology in improving productive forces and optimizing resource allocation, and adhere to the people-centered value orientation to ensure that digital dividends are shared by all farmers.

At present, digital technology empowering rural common prosperity faces multiple practical dilemmas, such as weak digital infrastructure, insufficient talent supply, poor technology adaptation, and uneven benefit distribution. These dilemmas are intertwined, restricting the effective transformation of digital dividends into the achievements of rural common prosperity. To solve these dilemmas, people must be based on the actual needs of rural development, build a systematic realization path from four dimensions: consolidating digital infrastructure, improving talent cultivation systems, promoting technology-scenario adaptation, improving benefit linkage mechanisms, and promoting the deep integration of digital technology and rural development [10].

Looking forward to the future, with the continuous development of new technologies such as artificial intelligence and the metaverse, digital technology empowering rural common prosperity will usher in new opportunities and challenges. Next, people should continue to deepen the integrated development of digital

technology with rural industries, governance, culture, and other fields, continuously improve the institutional system and policy guarantee for digital rural construction, promote digital technology to better serve rural common prosperity, and lay a solid foundation for building a modern socialist country in an all-round way.

Funding

This research was supported by the General Project of Philosophy and Social Science Research in Colleges and Universities of Jiangsu Province (2023): "Research on the Realization Mechanism of Rural Common Prosperity in the New Development Stage" (Project number: 2023SJYB2098).

Disclosure statement

The author declares no conflict of interest.

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