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An Analysis of the Challenges and Pathways for High-Quality Development of Rural Industries in the Context of Digital Rural Development

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Abstract: *Digital rural development is a strategic direction for rural revitalization and offers a historic opportunity for rural industries to shift from traditional extensive growth to high-quality development driven by data. This paper analyzes the core challenges facing rural industrial development in this context, including imbalanced infrastructure and factor support, insufficient digital capabilities and talent among rural industry actors, weak application of data resources and inadequate industrial chain collaboration, as well as an underdeveloped digital ecosystem and governance framework. Accordingly, it proposes targeted pathways: building new digital infrastructure and data foundations, cultivating multi-tiered digital actors and talent, promoting digital transformation and integrated innovation across industrial chains, and optimizing digital governance and service ecosystems.*

Keywords: *Digital Rural Development; High-Quality Industrial Development; Digital Divide; Industrial Chain Digitalization; Digital Ecosystem*

1. Introduction

With the rapid development of information technology, the digital economy has become a new engine for global growth. Digital rural construction is thus a strategic priority for rural revitalization and building a digital China. The Strategic Outline for Digital Rural Development in China states that digital rural development is an endogenous modernization process in agriculture and rural areas, driven by networking, informatization and digitalization, with the core aim of empowering rural industries, governance and public services.

High-quality development of rural industries is the economic cornerstone of rural revitalization, requiring a shift from scale and speed toward quality, efficiency, greenness and sustainability, with data integrated with traditional factors like land, labour, capital and technology.

However, in practice, digital technology has not seamlessly delivered tangible benefits, instead exposing structural and systemic contradictions. Clarifying these difficulties and exploring viable breakthrough pathways therefore hold significant theoretical and practical urgency.

2. Literature Review

International research on rural digital transformation has increasingly come to see that building infrastructure alone does not automatically unlock the promise of digital technologies. For instance, some researchers argue that sharing broadband infrastructure can cut both capital and operating costs for rural network rollout, but they also note that technical, regulatory, and socio-economic obstacles continue to limit how far this approach can scale in developing countries [1]. This lines up with what we see on the ground: rural digital infrastructure is still spread unevenly, and upgrading traditional agricultural facilities with intelligent systems is moving slowly.

A second line of work looks at the capability gap among smallholder farmers. A recent systematic review reports that ICT literacy tends to decline with age, that gender gaps deepen digital inequality, and that ignoring smallholders' social and cultural context can undermine technology adoption [2]. These patterns match the long-standing difficulty in Chinese agriculture, where smallholders with limited information literacy often struggle to take up complex digital tools. Similarly, research on

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digital agricultural extension services emphasizes that a trustworthy, inclusive, and sustainable ecosystem—characterized by two-way information flows, centralized information networks, and effective ICT training—is a prerequisite for moving smallholders from mere access to continuous and effective utilization [3].

A third group of studies turns to the mechanisms linking digital inclusion and rural industrial development. Drawing on panel data from Chinese rural e-commerce clusters, one recent study finds that digital inclusion drives rural industrialization by lowering information and transportation costs, with transaction costs acting as a mediating channel [4]. This mechanism-focused view gives us a useful lens for understanding why fragmented data flows and weak collaboration across segments hold back digital dividends. Evidence from provincial panel data also suggests that digital inclusive finance strengthens rural economic resilience mainly by improving transportation infrastructure and encouraging technological innovation, with rural digital infrastructure playing a moderating role [5]. Taken together, these findings suggest that the difficulties rural industries face under digital village construction are not simply technical—they are institutional and capability-related as well.

This paper makes three contributions. First, it brings infrastructure, data, actors, value chains, and governance together into one framework, treating them as interconnected dimensions of rural industrial digitalization rather than separate issues. Second, it pinpoints four structural dilemmas that hold back digital dividends in rural industries and traces them back to their institutional roots. Third, it lays out a systematic pathway framework that links digital foundations, talent cultivation, industrial chain transformation, and governance optimization—offering both analytical tools and practical guidance for high-quality rural industrial development.

3. Practical Dilemmas in the High-Quality Development of Rural Industries under the Background of Digital Villages

Although the construction of digital villages has achieved phased success, rural industries still face multiple deep-seated dilemmas, which constrain the full release of digital dividends. These dilemmas can be summarized into four main aspects.

3.1 Imbalanced Infrastructure Development and Inadequate Factor Support

It is obvious that the coverage of digital infrastructure remains neither deep nor uniform, and the intelligent transformation of traditional facilities lags behind [6]. The deployment of digital infrastructure, such as 5G, the Internet of Things (IoT), smart agricultural machinery, and cold chain logistics, is predominantly concentrated in county seats or central townships, making it difficult to effectively extend to front-line production areas and villages. It is worth noting that high-speed, stable, and low-cost internet access remains unrealized in some remote regions in rural areas. Simultaneously, the digital and intelligent transformation of a vast amount of traditional agricultural infrastructure, such as farmland irrigation systems, greenhouses, and breeding farms, requires substantial investment and progresses slowly, which results in a weak physical foundation for data collection.

From an input perspective, the foundation for realizing the value of data as a production factor remains weak. What merits attention is that fundamental tasks, especially data collection, processing, standardization, ownership determination, and transaction, are severely inadequate. Data on agriculture, rural areas, and farmers remain fragmented across departments, platforms, and enterprises. No unified standards or sharing mechanisms exist, and the result is a proliferation of data silos. Data quality is uneven, and security and privacy protection frameworks are underdeveloped. Consequently, data flows poorly and is difficult to convert into value.

Another constraint lies in the insufficient supply of supporting factors, particularly finance and technology. Financing the digital transformation of rural industries is difficult: risks are hard to identify, collateral is often lacking, and credit products remain undifferentiated. Technology poses a similar problem. Few digital solutions are designed with rural conditions in mind, and many advanced technologies, being costly and complex, are simply impractical to deploy.

3.2 The Capability Gap of Industrial Entities and Structural Shortage of Talent Pools

A further issue concerns the adaptability of smallholder farmers to modern digital production systems. Chinese agriculture is still dominated by smallholders, who farm on a limited scale, are

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weakly organized, and have limited information literacy. As a result, they generally lack either the motivation or the capacity to adopt digital technologies or to use data analysis for precision decision-making. The gap between the complexity of digital tools and the traditional character of agricultural production is considerable, which makes genuine absorption and internalization of these technologies difficult.

Although new types of business entities such as family farms, cooperatives, and leading agricultural enterprises possess a strong awareness of digital transformation, they also face challenges which include difficulties in selecting appropriate technologies, high investment risks, and a shortage of specialized talents. Currently, their digital applications are largely confined to production monitoring and e-commerce sales, which reflects the fact that there is insufficient exploration of digital management in full production process as well as innovation of data-driven business model. Generally, new types of agricultural business entities have not fully leveraged their potential role as exemplary models with a radiating influence.

At the same time, rural areas generally lack versatile professionals who possess both digital technology expertise and a deep understanding of agriculture and rural life. Local young people are migrating away from these areas, while external talents are reluctant to settle in rural communities due to limited career prospects, inadequate living amenities, and low compensation packages, which causes rural areas facing difficulties in attracting, cultivating, and retaining digital talents.

3.3 Insufficient Depth of Industrial Chain Digitalization and Fragmented Collaboration

Beyond a standalone industrial perspective, digital transformation of industrial chains shows strong points but weak links, resulting in low collaborative efficiency. Current digitalization focuses on individual segments like intelligent monitoring and live-streaming e-commerce, meaning a comprehensive digital closed-loop covering the entire value chain—from pre-production planning to quality traceability—has not yet been established. The lack of data interoperability and business synergy across segments limits overall operational efficiency and prevents networked collaborative effects.

A further weakness lies in the limited capacity to discover and create value through data-driven approaches. Most collected data serve only for display and basic analysis. Advanced intelligent decision-making powered by big data and artificial intelligence—market demand forecasting, production risk early warning, personalized product customization, supply chain optimization—remains largely absent. Data have therefore not yet become core assets capable of guiding production, improving quality, and generating new value.

Finally, the integration of new operational paradigms remains at a low level. In rural e-commerce, rural tourism and smart healthcare, new sectors flourish but are largely limited to simple online migration and superficial integration of traditional activities. Agricultural e-commerce platforms lack deep integration with production bases, farm-based experiences and cultural heritage exploration, while smart tourism lacks data-driven interpretation of local culture and ecological resources and immersive experiential design. Overall, effective data linkage and value derivation across business sectors remain deficient.

3.4 Inadequate Digital Ecosystem and Governance Framework

What has to be mentioned is that a robust digital governance framework and standardized norms require immediate improvement. The incomplete legal and policy framework governing rural data property rights, security, transactions, and use has left key standards missing or inconsistent, such as those for agricultural product quality and safety traceability, agricultural IoT device interfaces, and rural data resource catalogs, while making cross-platform and cross-entity interoperability costly. Together, these deficiencies constrain large-scale adoption.

Additionally, there is a shortage of both digital service provision and sustainable operational mechanisms in rural industries. It is common that many digital rural development projects are initiated and funded by the government, while they often prioritize construction over operation, lacking sustainable market-based operational frameworks and professional service teams. The service offerings are often disconnected from the actual needs of farmers and local industries, causing low utilization rates and suboptimal outcomes after project completion.

What’s more, the market competition environment and stakeholder relationships require further

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optimization. While large internet platforms expanding into rural markets generate significant traffic and distribution channels, they may also encroach upon the growth space of local small and medium-sized digital service providers and pose risks of data monopoly. It is because the interest-linkages between these platforms and farmers or cooperatives are often neither strong nor equitable that farmers occupy a disadvantaged position within the value chain and struggle to fairly share the benefits derived from digital value addition, which undermines their motivation to continue participating in the market.

4. Pathways for Promoting High-Quality Development of Rural Industries

Addressing the aforementioned challenges requires systematic planning and targeted policy interventions to establish a digital development framework for rural industries which is market-driven, data-powered, centered on key stakeholders, and supported by an ecological foundation. The specific implementation approaches can be divided into the following four aspects.

4.1 Building an Inclusive and Shared Digital Infrastructure and Data Resource System

Two priorities follow. The first is the targeted deployment and integrated application of new digital infrastructure, with industrial cluster areas and regions of distinctive advantage given priority. This entails on-demand 5G expansion, low-cost IoT sensor networks, and county-level smart cold-chain logistics centers together with end-point nodes. Government subsidies and market investment should be directed toward helping new business entities digitalize their traditional production facilities. The second priority is a unified framework and circulation mechanism for rural data resources. This requires top-down integration, governance, and standardization of agricultural data, the creation of an authoritative catalog and a shared exchange platform, and the piloting of rules for data rights confirmation, valuation, trading, and security protection. Public data may be shared with market entities in a limited and conditional manner, so as to stimulate innovation without compromising security and privacy.

It should not be overlooked that innovation in the provision of financial technology and digital technologies needs to be achieved[7]. For one thing, developing agricultural credit risk management models leveraging big data and the Internet of Things, and expanding the digital coverage of agricultural insurance so as to achieve precise assessment and smooth settlement processes are essential. For another, it is effective to establish funds for rural industrial digital development to guide private capital investment. Addressing the issue where overly complex technology makes it difficult to implement, it is necessary to encourage research institutions and technology enterprises to develop user-friendly digital service packages tailored to different regions and industries.

4.2 Building a Multi-Tiered and Endogenous Digital Development Framework to Cultivate Talent and Strengthening Capacities

With the purpose to implement digital empowerment for smallholder farmers, it is vital to promote organizational models including not only platforms which are usually considered enterprises but also cooperatives and farmers to seamlessly integrate smallholder farmers into digital production networks [8]. Developing user-friendly applications, such as WeChat mini programs, to provide managed services for digital agriculture and conduct training for rural users can help enhance their practical capabilities in accessing market information, implementing standardized production practices, and conducting online transactions, thereby lowering the barriers for smallholder farmers to adopt digital technologies.

Additionally, it is crucial to strengthen the cultivation of new types of business entities as pioneers in the deep application of data. A further step is to incorporate digital capability as a key criterion for identifying and supporting model cooperatives, family farms, and leading enterprises. These actors should be encouraged to take the lead in launching full-chain digitalization pilots and to set benchmarks for smart farms and digital workshops. They should also be encouraged to provide surrounding farmers with socialized services—disseminating digital technologies, offering data-driven services, and organizing unified marketing—thereby becoming lighthouses for the digital transformation of rural industries [9].

Equally necessary is a comprehensive talent support system that integrates attracting, nurturing, retaining, and employing talent. Priority should go to the Digital New Farmers Training Program, which provides systematic digital skills training for returning youth, veterans, and rural leaders.

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Flexible recruitment mechanisms should also be refined to draw urban intellectual resources through initiatives such as the Weekend Engineers program, Migratory Expert schemes, and project-based collaborations. It is apparent that sense of belonging and future career prospects play an important role in rural digital talents' decision to stay or leave. Therefore, improving the working and living conditions for rural digital professionals by offering preferential support in areas including entrepreneurship assistance, professional title evaluation, and social security benefits should be taken into consideration.

4.3 Deepen the Digital Transformation of Industrial Chains and Business Model Innovation

To drive the digital collaborative upgrading of the entire industrial chain, it is suggested that government should develops industrial digital maps to identify digital bottlenecks at critical links while considering counties as the basic unit and focusing on leading industries or specialized industrial clusters. Moreover, support leading enterprises or industrial alliances in taking the lead in establishing industrial internet platforms or data middle platforms that cover the entire industrial chain, enabling collaborative production planning, optimized logistics scheduling, full-process quality traceability, and precise alignment of production and sales, thereby enhancing the overall resilience and responsiveness of the industrial chain.

In addition, with the aim to unleash the value of data as a production factor to drive innovation, on the one hand, it is vital to encourage the use of big data analytics to forecast spending trends and guide strategies including production tailored to sales demand, variety improvement, and the development of functional agricultural products. On the other hand, measures should be taken to leverage artificial intelligence for intelligent identification of pests and diseases, yield forecasting, and smart environmental management. At a deep level, greater attention should be paid to fostering new business models rooted in data-driven trust such as digital adoption agriculture, contract farming, and shared agriculture, to enhance product value-added and customer loyalty.

There is no doubt that promoting the integration of the digital and real economies is driving the emergence of new business models, which will foster the deep integration of digital technologies with agricultural and rural resources. Beyond developing immersive and experiential smart rural tourism initiatives, leveraging data mining to unlock rural cultural IP and creating digital cultural and creative products are also excellent pathways. Further still, not only upgrading rural e-commerce from a model focused solely on selling products to one that encompasses selling services, experiences and culture[10], but also exploring the integration of smart healthcare, telemedicine, and digital inclusive finance with rural contexts to expand the boundaries of rural industries will play an essential role in promoting the high-quality development of rural industries.

4.4 Enhance Digital Governance and Foster a Thriving Development Ecosystem

A comprehensive set of standards for digital rural governance might be built in several ways. Local regulations or policies should be enacted first, clearly defining the rights and obligations of all parties involved in data collection, data utilization, and revenue distribution. Unified technical and management standards should then be formulated and promoted in key areas, notably quality traceability for specialty agricultural products and rural digital services. A robust network and data security framework is likewise needed to strengthen risk prevention.

A diversified, collaborative, and benefit-sharing market ecosystem also deserves attention. Clearly defining the boundary between government and market is essential: government should concentrate on establishing platforms, setting rules, and providing inclusive services. Platform enterprises, digital service providers, local businesses, farmers, and other stakeholders should meanwhile be encouraged to form partnerships grounded in complementary strengths and shared benefits. Furthermore, to ensure that smallholder farmers receive fair returns in the digital value chain, it is necessary to explore revenue-sharing mechanisms enabled by blockchain and other technologies.

To ensure long-term sustainability, a service model integrating construction and operation should be adopted, with sustainable operational arrangements planned from project outset. Multiple models may be explored, including government procurement of services, enterprise-led construction and operation under government oversight, and self-operation by cooperatives. Local and professional integrated service providers should also be cultivated so that digital applications are well adopted, locally rooted, and sustained over time.

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5. Conclusion

In the context of digital rural development, high-quality development of rural industries represents a profound systemic transformation—not merely a technological superposition, but a comprehensive reshaping of infrastructure, production factors, industrial entities, industrial chains and governance systems. Current difficulties essentially reflect the tension between the traditional rural industrial system and digital development requirements—growing pains inevitable in the course of development.

Overcoming these challenges requires systematic thinking and a long-term perspective: strengthening the digital foundation, bridging infrastructure and access divides, enhancing industrial capabilities, fostering industrial chain synergy and a robust ecosystem, and stimulating market vitality alongside government guidance. Future pathways should build an inclusive, collaborative, open and innovative digital rural ecosystem—one that enables data to flow freely, encourages diverse stakeholder participation and sustains innovation momentum.

Ultimately, the success of rural industrial digital transformation will be reflected not only in economic indicators but also in improved agricultural production methods, enhanced farmers' digital literacy, optimized rural social structures and deepened urban–rural integration, laying a solid foundation for agricultural and rural modernization.

References

[1] Nyaura Kibinda et al. Broadband infrastructure sharing as a catalyst for rural digital economy: A systematic review for developing countries[J]. Telecommunications Policy, 2025, 49(8): 103028.
[2] Yuyang Yuan and Yong Sun. Practices, Challenges, and Future of Digital Transformation in Smallholder Agriculture: Insights from a Literature Review[J]. Agriculture, 2024, 14(12): 2193.
[3] Le Thi Hoa Sen et al. The Opportunities and Barriers in Developing Interactive Digital Extension Services for Smallholder Farmers as a Pathway to Sustainable Agriculture: A Systematic Review[J]. Sustainability, 2025, 17(7): 3007.
[4] Luyan Huang and Zhan Cao and Dongxun Liu. Digital inclusion, transaction costs, and rural revitalization industrialization: Evidence from rural e-commerce clusters in China[J]. Finance Research Letters, 2025, 86(PF): 108810.
[5] Ma Y, Wei R, Bi H, How does digital inclusive finance enhance rural economic resilience? A study based on provincial panel data in China[J]. PLoS ONE, 2025, 20(4): e0321630.
[6] Koen Salemink and Leanne Townsend and Polly Chapman. The remapping of rural digitalisation: A just-rural narrative review[J]. Journal of Rural Studies, 2025, 113: 103499.
[7] Jingting Yang and Chen Wang and Haihong Guo. The Impact of Digital Inclusive Finance on the High-Quality Development of Rural Industries—Evidence from China[J]. Sustainability, 2026, 18(13): 6825.
[8] Linfeng Mei et al. Driven by the policy or bent by the market? Cracking the digital transformation code of farmer cooperatives[J]. Technological Forecasting & Social Change, 2024, 208: 123659.
[9] Shucui Wang et al. The impact of the digital economy on rural industrial revitalization[J]. Research in International Business and Finance, 2025, 76: 102878.
[10] Jie Hou and Yi Liu. Assessing the impact of rural E-commerce on regional poverty alleviation: A spatial spillover analysis[J]. International Review of Economics and Finance, 2024, 94: 103399.