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CHINA'S DIGITAL VILLAGE DEVELOPMENT: REALITIES, PATHWAYS, AND MECHANISMS

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Abstract: Digital technology is an indispensable productive force for rural development. Building digital villages requires transforming the inherent advantages of digital technology into effective mediators for rural modernization, driving comprehensive innovation in rural production and lifestyles. However, China faces practical challenges in leveraging digital technology for rural modernization: insufficient momentum in "new infrastructure" development, a lack of key actors, inadequate government oversight, digital capability gaps within grassroots organizations, and spatial digital divides. Addressing these requires strengthening physical infrastructure, cultivating digital literacy among stakeholders, optimizing policy design, integrating autonomy, rule of law, and virtue-based governance, and bridging spatial disparities. The Chinese government has established a systematic action mechanism for digital village development: (1) Foundation-building mechanism: Consolidating physical infrastructure; (2) Co-creation mechanism: Integrating external forces to ensure stakeholder engagement; (3) Capacity-enhancement mechanism: Addressing capability gaps through digital education; (4) Collaborative mechanism: Restructuring organizations to synergize multi-stakeholder efforts.
Keywords: Digital technology; Digital village; Realistic Landscape; Mechanism; Pathway

1 INTRODUCTION

Digital villages represent a critical focus for advancing national modernization in the digital era. This involves embedding digital technology into rural socio-economic structures to modernize agriculture, rural areas, and farmers, utilizing key tools like big data, blockchain, and AI. This paper examines the value logic, current realities, implementation pathways, and action mechanisms of China's digital village development. It seeks to transform the inherent advantages of digital technology into effective mediators for high-quality digital village development, offering theoretical insights for developing nations pursuing rural modernization.

2 THE VALUE LOGIC OF DIGITAL TECHNOLOGY EMPOWERING RURAL MODERNIZATION

Digital technology empowers rural modernization by bridging dual gaps—between urban and rural areas, and among market entities—thereby enhancing fundamental market dynamics.

2.1 Economic Drivers

This empowerment aligns with China’s socio-economic imperatives[1-3]. Macroscopically, China's digital economy surged from RMB 11 trillion in 2012 to RMB 50.2 trillion in 2022, with an average annual growth rate exceeding 50%. Microscopically, provinces like Jiangsu exemplify rapid digital advancement: it pioneered provincial digital economy regulations, hosts four national advanced manufacturing clusters (the highest nationally), and saw high-tech and strategic emerging industry outputs rise to 48.5% and 40.8% of total industrial output, respectively. Jiangsu's digital economy reached RMB 5.1 trillion in 2022, ranking second nationally and accounting for 11.8% of the national total; its core industries contributed 10.6% to provincial GDP.

Stimulated by the digital economy, rural China is undergoing rapid transformation[4-6]. The 2022 National County-Level Digital Agriculture and Rural Development Evaluation Report indicates: 77.7% of counties established agricultural informatization agencies; county-level digital agriculture investments totaled RMB 12.9 billion; per capita telecom consumption exceeded RMB 500; agricultural production digitization reached 18.6%; e-commerce covered 64% of administrative villages, with online agricultural retail sales hitting RMB 554.2 billion (9.8% of total transactions); and 49.7% of villages benefited from "Information Entry to Villages" stations. As a strategic nexus of national cyberpower and rural revitalization, digital villages demonstrably enhance agricultural efficiency, farmer incomes, and rural prosperity.

These trends reveal how digitalization reshapes rural economic relations and governance structures[7-9]. Thus, digital empowerment of rural modernization is a strategic response to developmental trends, holding profound significance.

2.2 Mediating Capacity

The Digital Village Development Strategy Outline formalized the concept, targeting full realization by mid-century. Scholarship has since explored its implications, often viewing digital transformation instrumentally—as a mediator for rural development. For instance, Li Gan (2021) defines it as applying next-generation IT to drive rural transformation[10]; Wang Sheng and Yu Na (2021) similarly emphasize leveraging digital paradigms for holistic advancement[11]. However, such perspectives can overlook the intrinsic transformative power of the technology itself. Digital village development should be understood as a systemic overhaul of rural life and production driven by IT—a new productive force essential for modernization. It constitutes a complex system requiring integrated approaches.

2.3 Potential Effects

Amidst the rise of the digital and platform economies, industrial digitization and digital industrialization dominate China's industrial upgrading, with provinces competing to formulate long-term digital strategies[12-14]. The potential effects are significant:

Foundation for Digital China: Digital villages form the bedrock of national digital transformation, embodying its most challenging yet crucial aspect. Success here is pivotal for Digital China.

Catalyst for Rural Modernization: It represents an endogenous opportunity for high-quality rural modernization—not merely a means to revitalization, but an inevitable developmental phase aligned with productive forces.

Driver of Urban-Rural Integration: It holds potential to narrow regional (east-central-west) and urban-rural disparities. While research shows digital economies can both mitigate and exacerbate the "digital divide," targeted enablement policies can foster inclusive resource allocation and integration[15].

3 THE REALISTIC LANDSCAPE OF DIGITAL TECHNOLOGY EMPOWERING RURAL MODERNIZATION

A systematic analysis across five dimensions—entity, agency, institution, governance, and environment—reveals key tensions and challenges.

3.1 Entity Dimension: Weak "New Infrastructure" & Agricultural Digitalization Dilemma

Entity encompasses physical elements: 5G, AI, industrial IoT, digital infrastructure, and data resources[16]. Challenges include:

Inadequate "New Infrastructure" Momentum: National funding for rural digital infrastructure remains insufficient and fragmented. Capital-driven projects (e.g., 5G, AI, data centers) stall in vast rural areas due to market spillover limitations. Historical underinvestment in high-tech "software" versus tangible "hardware" exacerbates technological shortfalls[17].

Agricultural Digitalization Difficulties: High costs, implementation complexity, and lack of national-level top-level design hinder progress. Unlike other sectors, agricultural data relies heavily on production-side data, which is hard to collect due to natural uncertainties, making low-cost sustainability elusive. Blindly replicating general digitization principles ignores agricultural uniqueness, risking unsustainable, capital-intensive pseudo-digitization.

3.2 Agency Dimension: Absence and Deficits of Key Actors

Challenges involve both absence (digital professionals, digitally active populations)[18] and deficits(misconceptions, skill gaps):

Actor Absence: Rural brain drain and hollowing-out (especially in central/western regions, per CNNIC 2023 data on youth migration) deprive villages of endogenous digital momentum and skilled users. Systemic barriers hinder talent retention.

Actor Deficits: Some officials underestimate digital villages' importance or resist adoption; some technologists exhibit techno-optimism, neglecting social science insights and risks. Rural residents often lack smartphone/internet proficiency. These deficits form fundamental barriers.

3.3 Institution Dimension: Inadequate Government & Market Oversight

The Rural Revitalization Promotion Law mandates digital villages but lacks a supporting regulatory framework:

Government Oversight Gaps: Agricultural data management lacks laws and standards, leading to data silos or unequal access/distribution, potentially creating new inequalities[19].

Market Regulation Vacuum: Policies are lacking to manage capital influx into agricultural digitization. While agribusinesses hold advantages (capital, tech, data), unchecked capital dominance risks marginalizing smallholders and generating socio-economic threats.

3.4 Governance Dimension: Gaps in Grassroots Capacity & "Tripartite + Digital" Integration

Digital governance remains nascent, largely confined to communication:

Grassroots Leadership Challenge: Village Party organizations struggle to lead effectively in the complex, virtualized, multi-actor digital governance landscape.
Integration Gap with "Tripartite Governance": Embedding digital governance within the autonomy-rule of law-virtue framework is unclear. The high technical costs and management burden of public digital platforms challenge local governments transitioning amidst an incomplete "tripartite" system.

3.5 Environment Dimension: Persistent Digital Divides

International Gap: China's digital villages lag behind developed nations (e.g., UK's systemic digital agriculture, US digital urban-rural fusion, Japan/Korea's industrial restructuring). Learning from global experience is under-prioritized.
Domestic Disparities: Imbalances mirror regional economic gaps. Eastern coastal areas approach international levels, while the west lags, creating a "digital divide" hindering common prosperity[20].

4 IMPLEMENTATION PATHWAYS FOR DIGITAL TECHNOLOGY EMPOWERING RURAL MODERNIZATION

Informed by the five-dimensional analysis, the *Digital Village Development Action Plan (2022-2025)*outlines pathways:

4.1 Strengthening the Entity Foundation

Mobilize funds: National special funds + local policies attracting social capital for infrastructure.
Boost tech supply: Strengthen R&D support, leverage universities/enterprises for localized models.
Advance agricultural digitization: Develop China-specific strategies, prioritize production data collection/integration (e.g., via data stations, unified databases).

4.2 Cultivating Agency as Key Resource

Address absence: Align higher/vocational education with needs; create incentivized talent channels.
Remedy deficits: Enhance policy interpretation for officials/technologists; implement tiered digital literacy programs for residents; retain traditional service options for the digitally excluded.

4.3 Optimizing Institutional Policy Arrangements

Government: Legislating agricultural data management for equitable sharing.
Market: Regulating capital involvement ("utilize but restrain"), protecting smallholders/cooperatives, setting boundaries against disorderly expansion.

4.4 Enhancing Governance as Core Means

Empower grassroots: Utilize digital platforms for democratic consultation; accelerate government digital transition.
Explore integration: Develop pathways for embedding digital governance within the "tripartite governance" framework.
Theoretical design: Academic research on integrating digital governance with the autonomy-law-virtue system.

4.5 Shaping the Environment for Future Orientation

Learn internationally: Systematically study foreign digital village models; foster rural-level international exchange.
Bridge domestic divides: Use fiscal tools, promote regional integration and urban-rural digital fusion.

5 ACTION MECHANISMS FOR DIGITAL TECHNOLOGY EMPOWERING RURAL MODERNIZATION

China employs a systemic "holistic" action mechanism:

5.1 Foundation-Building Mechanism

Upgrade hardware: Expand rural 5G coverage, negotiate affordable data plans.
Pilot & scale: Establish provincial digital agriculture pilots (IoT, blockchain, data stations), then national rollout[21].
Build unified platforms: National data-sharing/government service platform to avoid redundancy, ensure equity/security.

5.2 Co-Creation Mechanism

Engage migrant workers: Village committees establish contact (e.g., WeChat groups), share developments, build interest alignment, encourage participation/return.

Integrate academia: Government-led university-village pairing; incorporate digital village work in research/student requirements; create talent channels.

5.3 Capacity-Enhancement Mechanism

Correct misconceptions: Policy briefings, expert lectures.
Digital literacy programs: Tiered training (e.g., e-commerce workshops, online agri-tech courses, cooperative-based equipment training like blockchain for traceability/value addition).

5.4 Collaborative Mechanism

Phase 1: Tripartite Synergy: Government leads, integrates resources; market entities boost digitization; academia provides tech/talent; legal safeguards established.
Phase 2: Multi-Actor Advancement: Grassroots organizations coordinate; actors collaborate via digital platforms for modern production/life.
Phase 3: Mature Autonomy: Administrative input phased out; self-sustaining multi-stakeholder synergy drives endogenous digital development.

6 Conclusion and Prospects

6.1 Research Conclusions

This study systematically deconstructs the realistic landscape, implementation pathways, and action mechanisms of digital village construction in China. Empirical evidence reveals that digital technology serves as a transformative mediator for rural modernization, yet its empowerment faces multidimensional constraints: insufficient "new infrastructure" investment, dual deficiencies in practice agency (absence of skilled talent and capability gaps among residents), regulatory voids in data governance and capital oversight, disjunctures between digital governance and the "autonomy-rule of law-virtue" tripartite framework, and persistent digital divides across regions and urban-rural spheres.
To address these challenges, China has pioneered a systematic action framework:
Entity Foundation: Prioritizing infrastructure upgrades and agricultural digitization tailored to rural realities;
Agency Optimization: Cultivating digital literacy through education and talent retention policies;
Institutional Innovation: Balancing data equity and capital regulation to protect smallholders;
Governance Synergy: Embedding digital tools within grassroots governance structures;
Environmental Bridging: Learning from global models while narrowing domestic disparities.
The proposed four-phase action mechanism—foundation-building, co-creation, capacity-enhancement, and collaboration—demonstrates how multi-stakeholder synergy (government, market, academia) can convert technological advantages into endogenous momentum for rural revitalization.

6.2 Future Prospects

Future efforts should focus on three dimensions:
Technical Adaptation: Developing cost-effective agricultural IoT and blockchain solutions for small-scale farming, reducing data collection barriers while enhancing traceability value chains.
Policy Refinement: Establishing differentiated digital literacy evaluation systems and dynamic capital supervision frameworks to prevent market monopolies and protect vulnerable groups.
Theoretical Innovation: Constructing a "Digital Village Maturity Model" to quantify governance efficacy and spatial spillover effects, particularly in central/western regions.
Internationally, comparative studies on digital village paradigms (e.g., EU smart villages, Japan's Society 5.0) will enrich China's approach. Crucially, integrating "new quality productive forces" with place-based strategies could redefine rural modernity, offering a replicable model for Global South development. As digital and ecological transitions converge, China's experience may pioneer sustainable ruralism in the intelligent era.

COMPETING INTERESTS

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