

Application and prospect of digital technology in rural economy

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ABSTRACT

As the information age begins, digital technology is playing a crucial role in the rural economy. This study examines precision agriculture technologies (GIS, GPS, RS), IoT applications, intelligent machinery, and big data analytics, focusing on their current status and benefits. Empirical analysis through case studies evaluates the impact of technologies like mobile payments, online education, and e-commerce on rural income growth and production efficiency. Results show that digital tools improve agricultural quality, reduce market information asymmetry via platforms like Alipay and WeChat Pay, and optimize resource allocation. Online education and e-commerce bring advanced resources and market opportunities to rural areas, boosting farmer incomes. However, challenges such as the digital divide, insufficient infrastructure, and lack of skilled workers remain. The study suggests solutions including policy support, training, infrastructure upgrades, and innovation ecosystems. It also predicts that ongoing advancements in digital and intelligent technologies will enhance the rural economy's vitality and help bridge the digital divide.

KEYWORDS

Digital Technology Application; Rural Economy; Precision Agriculture; E-commerce; Technology Promotion Strategies

1 Introduction

1.1 Research background

The application and prospects of digital technology in rural economies are drawing growing attention. With advancements in big data, 5G, and artificial intelligence, the digital economy is transforming agriculture and other industries. However, limited penetration of digital technology hinders productivity improvements and agricultural transformation. In the next phase of rural development, promoting digital technology is crucial for upgrading the rural economic system. Insufficient infrastructure and IT capabilities in rural areas remain barriers to technology adoption and information access. This underscores the need for solutions to enhance digital connectivity between urban and rural areas, fostering economic integration. This study uses literature analysis, empirical research, and case studies to examine the status and potential of digital technology in rural economies. Combining quantitative and qualitative methods, it evaluates digital technology's role in advancing agricultural modernization and rural revitalization, emphasizing its importance for sustainable development. The study provides theoretical support and empirical evidence for policymakers and practitioners, promoting digital-rural economic integration. It supports rural revitalization by enhancing quality and competitiveness, offering new pathways for agricultural modernization.

1.2 Research content

This paper primarily focuses on the application of digital technology in rural economies and its prospects, aiming to explore how digital technology can effectively promote the development of rural economies. The research will concentrate on the impact of digital technology on agricultural production, the agricultural industry chain, rural financial services, and improvements in farmers' lives. Through data analysis and case studies, it will examine the specific applications of digital technology in rural economies and evaluate their effectiveness and potential for development. The research objective is to clarify the importance and necessity of digital technology in revitalizing rural economies, thereby providing a reference for policymakers. In the research process, the main innovation of this paper lies in the comprehensive evaluation and analysis of the effectiveness of digital technology applications. From multiple perspectives such as policy orientation, application models, and technical support, it explores the applicability and feasibility of digital technology at different levels of rural economic development. In light of the challenges and issues present in reality, this paper proposes targeted improvement suggestions, emphasizing the need to enhance farmers' digital literacy to ensure that digital technology more effectively serves the sustainable development of rural economies.

2 Overview of digital technology

2.1 Development of digital technology

The origins of digital technology date back to the mid-20th century. In the 1950s, transistor and computer program

advancements launched classical computing, revolutionizing information processing. By the 1970s, integrated circuits reduced device size while boosting computational power and cost-effectiveness, driving digital technology adoption. In the 1980s, the Internet emerged as a pivotal milestone for rapid information sharing, fueling the information industry's growth. The 1990s saw the World Wide Web enabling mass access to web-based applications, marking the start of the information age. Network technologies (e.g., TCP/IP) and multimedia integration improved digital content creation and dissemination. In the 21st century, mobile internet and smartphones expanded digital technology applications. Big data, cloud computing, and IoT have driven cross-industry digital transformation, offering rural economies new opportunities through agricultural big data, smart irrigation, and precision agriculture. Recently, blockchain has enhanced digital trust and transaction security, with potential in rural finance and supply chain management. Artificial intelligence, particularly machine learning and deep learning, has made data analysis and decision-making more intelligent. Continuous digital innovation has transformed rural economies. Looking ahead, 5G deployment will improve rural network coverage, promoting smart villages and forming a multi-level digital economic ecosystem.

2.2 Application of digital technology in agriculture

The development of digital technology dates back to the mid-20th century. In the 1950s, innovations in transistors and computer programs marked the beginning of classic computer technology, significantly enhancing information processing capabilities. The 1970s saw the invention of integrated circuits, which reduced device size, increased computational power, and improved cost-effectiveness, driving widespread adoption of digital technology. In the 1980s, the emergence of the Internet became a key milestone, providing infrastructure for rapid information transmission and fueling the growth of the information industry. The 1990s brought the World Wide Web, enabling mass access to network applications through web pages and marking the start of the information age. During this period, technologies like TCP/IP and multimedia enhanced digital content creation and dissemination. In the 21st century, mobile internet and smartphones expanded the scope of digital technology. The integration of big data, cloud computing, and IoT has driven digital transformation across industries, improving efficiency in rural economies through applications like agricultural big data and precision agriculture. Continuous innovation in digital technology is transforming rural economies. Future developments, such as 5G, will enhance rural network coverage, support smart villages and digital farmland projects, and create a multi-level digital economic ecosystem.

3 Current situation of rural economy

3.1 Analysis of the characteristics of rural economy

The rural economy is characterized by resource distribution, industrial structure, and labor markets. Rural resources are primarily natural, with abundant land, minerals, and water, but uneven distribution creates regional development disparities. For example, China has 129 million hectares of arable land in 2023, yet quality and efficiency vary significantly among provinces, affecting agricultural productivity. The rural economic structure, centered on agriculture, has shifted from traditional to modern practices. While agriculture's share in the national economy declines, digital and ecological farming enhance value-added and sustainability. Technologies like smart greenhouses and drones increase yields by 15%-30%. In the labor market, rural-to-urban migration dominates income sources. In 2022, 190 million rural workers migrated, accounting for 37% of the rural workforce, causing a brain drain. However, the digital economy attracts young talent back, promoting diversification. Rural financial services remain underdeveloped due to information asymmetry and lack of collateral, limiting farmer financing. Despite a 15% credit balance increase from 2019 to 2022, per capita loans for farmers are only 20% of urban enterprise loans. Effective financial support is critical for rural transformation. Market demand in rural areas is diversifying, shifting from basic grains to high-quality products and services. Healthy lifestyles boost organic food consumption, while e-commerce expands sales channels, reaching 1.5 trillion yuan in 2022, up 30% year-on-year. Policies support rural revitalization through measures like land transfer and cooperatives, fostering new agricultural business models. Digital technology drives rural economic upgrading, contributing to high-quality development.

3.2 Application cases of digital technology in rural economy

The application of digital technology in rural economies has improved efficiency and income. For example, China's smart agriculture uses IoT for soil monitoring and crop management. Sensors monitor soil moisture, temperature, and nutrients in real time, while cloud platforms analyze the data to guide irrigation and fertilization, increasing yields by 30% compared to traditional methods. Big data helps farmers predict market demand, avoid overplanting, and reduce unsold products. E-commerce enables direct sales to consumers, cutting out intermediaries. A village's e-commerce platform

boosted annual sales by 2 million yuan, increasing farmers' income. Smartphones and social media expand market reach through product promotion. Blockchain enhances traceability and transparency. Some areas use blockchain to record every step from planting to sales, allowing consumers to trace product origins via QR codes, boosting trust and competitiveness. Drones improve farmland management by increasing spraying efficiency by 50%, reducing chemical use, lowering costs, and promoting environmental protection. Farmers' cooperatives integrate resources on digital platforms, using data analysis to optimize planting plans and market strategies, increasing average annual income by over 15%. Intelligent breeding uses sensors to monitor animal health in real time, detect diseases early, reduce losses, and increase profits by 20%. Overall, digital technology has enhanced production efficiency, income levels, and provided new opportunities for sustainable rural development.

4 Evaluation of the application effect of digital technology

4.1 Application effectiveness and problem analysis

The integration of digital technology into rural economies has driven advancements in agriculture, market circulation, and information services. Precision agriculture enables real-time crop monitoring and data analysis, increasing yields per unit area. For example, pilot regions using remote sensing and soil sensors saw rice yields rise by over 15%. Data-driven models help farmers optimize planting schedules and fertilizer use, improving input-output efficiency. Agricultural e-commerce platforms have expanded sales channels, with annual growth exceeding 40% in some areas. Information technology has also improved rural finance. Internet-based services have shortened loan approval times from weeks to 3-5 days. Big data risk models enhance credit evaluations, improving fund allocation. However, limited IT skills among some farmers hinder full adoption, widening disparities in accessing agricultural loans. Despite progress, challenges remain. Insufficient infrastructure in remote areas limits broadband coverage, preventing many farmers from fully benefiting. Network coverage is as low as 60% in some regions. A lack of technical training further slows adoption, especially among older farmers. Additionally, concerns about data security and privacy persist. About 70% of farmers worry about misuse of their personal data, discouraging engagement with digital services. Robust data protection frameworks and awareness campaigns are needed. In summary, while digital technology offers opportunities for agricultural modernization, addressing infrastructure, training, and data security challenges is essential to realize its full potential.

4.2 Strategies to improve application efficiency

To enhance the application of digital technology in rural economies, strategies can focus on four key areas: technology integration, resource optimization, personnel training, and policy support. For technology integration, combining big data, IoT, and AI can create an intelligent agricultural management system. Sensors collecting soil moisture and climate data can optimize irrigation and fertilization, potentially increasing yields by over 15%. Blockchain ensures transparency in supply chains, reducing costs and losses. Resource optimization can be achieved through shared platforms. Rural cooperatives integrating agricultural inputs and services improve utilization rates; collective procurement of machinery can reduce costs by 20%. Cloud computing monitors production processes, enabling better planning and efficiency. For policy support, governments should increase subsidies and tax incentives to lower barriers for adopting new technologies. Project subsidies could help implement 7,000 agricultural projects within three years, benefiting 8,000 farming households. Strengthening laws protects farmers' rights and mitigates risks during digitalization.

5 Summary and Outlook

The rapid development of digital technology is transforming the rural economy and driving revitalization. Technologies like big data, cloud computing, and IoT have improved the intelligence of production, management, and service systems, enabling real-time matching of agricultural supply and demand, enhancing market responsiveness, and optimizing resource allocation. In recent years, farmers have connected directly with consumers via mobile internet platforms, reducing intermediaries and boosting income. For example, live-streaming sales on short video platforms have increased individual farmers' revenue by over 30% in some areas. Digital agriculture has enabled precision planting and smart farming. Drones for field inspections and pesticide spraying improve efficiency while reducing pesticide use and environmental impact. Smart greenhouses with sensors and automatic controls regulate climate conditions in real time, increasing crop yield and quality. Studies show farms using intelligent equipment achieve 20%-50% higher yields than traditional farms. In finance, digital technology has expanded access to rural financial services. P2P lending and digital credit platforms allow farmers to secure loans without collateral, addressing financing challenges. Data analysis and credit scoring systems streamline loan reviews and improve capital turnover. Looking ahead, the application of digital

technology in rural economies will deepen. By 2030, the smart agriculture market is expected to reach the trillion level. National policies will support digital infrastructure, such as full 5G coverage, reducing the digital divide and ensuring equitable information flow. Digital skills training will empower farmers, enhancing participation and income levels. Despite progress, challenges remain, including data security, privacy protection, and uneven technology adoption. Future efforts should focus on building robust institutional frameworks, strengthening supervision, promoting synergy among technologies, and ensuring sustainable rural economic development. With digital technology, the rural economy can become more efficient, green, and inclusive.

References

- [1] D Kumar, M Sekher. Minimum Support Price and the Changing Nature of Rural Economy and Its Implications on Agriculture in Haryana[D]. Business Perspectives & Research, 2023.
- [2] R Gusmanov, E Stovba, A Paptsov, et al. Scenario Forecasting of the Agri-Food Sphere in Rural Territories Development in the Conditions of Digital Economy Formation[D]. Journal of Industrial Integration & Management Innovation & Entrepreneurship, 2022.
- [3] Qian Minghui, Pan Fei, Qi Yue. — Issues, Trends and Countermeasures of Digital Economy Development in China's Agriculture and Rural Areas after the Post-COVID-19 Pandemic [J]. Chinese Journal of Agricultural Resources and Regional Planning, 2021.
- [4] Lu Yi. "Research on the Influencing Factors of Rural Innovation Enterprises 'Entrepreneurship under the Background of' Science, Commerce and Agriculture' [J]., 2023.
- [5] ZL Huang. A Study of Finance Entering into Villages and the Changes in Rural Economy: Focusing on Guanzhong area in Shannxi from 1933 to 1945[D]. Collected Papers of History Studies, 2019.
- [6] Li Peng. Discussion on the Integration of Digital Economy and Rural Economy [J]. Times People, 2023.
- [7] Gu Wenjia. Research on the Impact of Digital Economy on High-quality Agricultural Development in Western China [J]., 2023.
- [8] Li Ming. Application of digital technology in rural radio and television wireless coverage [J]., 2021.
- [9] Agricultural Engineering and Information Technology. Quantitative Study on Digital Rural Policies in the Central Six Provinces from the Perspective of Policy Tools [J]. 2023.
- [10] Chen Hongqin. The intrinsic value of new quality productivity to empower the development of rural e-commerce, practical challenges and path exploration [J]., 2024.
- [11] Dong Haifeng, Xiong Weiye. Suggestions on the Integration of Digital Technology and Rural Economy [J]. Communication World, 2024.
- [12] Ding Bin Ling. Research on the Path and Support System of Digital Economy Empowering the Development of Rural Industries in Zhuzhou City [J]. 2023.
- [13] Tang Weijie. Research on the Path of Digital Technology Embedded in Rural Community Governance [J]. 2023.
- [14] Huang Dunping, Wang Yu. Countermeasures for the High-quality Development of Rural Cooperative Economy with the Empowerment of Digital Technology [J]. China Cooperative Economy, 2022.
- [15] Ma Jia. Application and Challenges of Digital Technology in Rural Cultural Industry Economy [J]. Shanxi Agricultural Economy, 2024.