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Research on the Path of Rural Revitalization Driven by the Double Wheel of Digital Transformation and Ecological Civilization Construction

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Abstract: *Rural revitalization strategy is an important component of socialism with Chinese characteristics in the new era, and it is a necessary way to realize the comprehensive construction of a modern socialist country. This paper explores the new path of rural revitalization from the dual perspectives of digital transformation and ecological civilization construction. By analyzing the impact of digital transformation on rural industries, governance and services, as well as the importance of ecological civilization construction to the sustainable development of the countryside, the authors propose a strategy to synergistically promote rural revitalization through digitalization and ecological initiatives. The study finds that digital transformation can improve rural production efficiency, optimize resource allocation, and innovate the governance model; while ecological civilization construction can help protect the rural environment, develop green industries, and improve the quality of rural life. The article concludes with some recommendations, including strengthening the construction of digital infrastructure, cultivating digital talents, and improving the ecological compensation mechanism. These recommendations aim to provide theoretical support and practical guidance for promoting the comprehensive revitalization of the countryside.*

Keywords: *rural revitalization, digital transformation, ecological civilization construction, path research*

1. Introduction

The Report of the 20th National Congress of the Communist Party of China clearly pointed out that comprehensively promoting rural revitalization is a major task for realizing the great rejuvenation of the Chinese nation. In the new historical period, how to promote rural revitalization through digital transformation and ecological civilization construction has become an important topic of common concern in the theoretical and practical fields. This study aims to explore the path of rural revitalization under the twofold strategy of digital transformation and ecological civilization construction, and to provide new ideas and methods for promoting agricultural and rural modernization.

1.1 Background of the study

As socialism with Chinese characteristics enters a new era, the implementation of the rural revitalization strategy faces new opportunities and challenges. On the one hand, the rapid development of digital technology has injected new impetus into rural development and provided innovative tools for solving the "three rural issues" (agriculture, rural areas, and farmers). On the other hand, the in-depth advancement of ecological civilization construction has pointed the way to the sustainable development of the countryside. It has also created the conditions for optimizing the rural living environment and improving the quality of life of farmers.

1.2 Significance of the study

The theoretical significance of this study lies in the following: Firstly, it enriches the theory of rural revitalization, combines digital transformation and ecological civilization construction organically, and expands the new dimension of rural development. Secondly, it deepens the Marxist theory on urban-rural relations and provides new ideas for promoting urban-rural integrated development in the new era.

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The practical significance lies in the following: Firstly, it provides a theoretical basis for the formulation of rural revitalization policies and helps government departments to formulate more scientific and effective rural development strategies. Secondly, it provides an operable path for rural practice, which is conducive to the better participation of grass-roots organizations and farmers in rural construction.

1.3 Literature review

Scholars at home and abroad have conducted a lot of research on rural revitalization, digital transformation and ecological civilization construction. In terms of rural revitalization, Pan Chuanhui (2024) pointed out that in order to achieve the five strategic objectives of rural revitalization, it is necessary to rely on the assistance of continuing education to truly improve the labor skills of villagers and enhance the quality of the villagers' population Based on this, the development path of continuing education service digital rural construction in the context of rural revitalization is elaborated in detail from different perspectives, so as to cultivate more new types of farmers and to provide the promotion of the digital rural transformation Theoretical basis[1].Sun Yali and Xing Shangzhen (2024) studied rural revitalization, that is, to promote the comprehensive development of rural production, life and ecology, and to promote the comprehensive revitalization of agriculture, rural areas and farmers, and the comprehensive promotion of rural revitalization is of great significance to national development. Therefore, the significance of rural revitalization strategy should be deeply understood, flexibly respond to the various challenges of promoting rural revitalization, explore the countermeasures to help rural revitalization in a multi-dimensional way, and continuously promote the modernization and development of agriculture and rural areas[2].

In terms of digital transformation, Zeng Shenxing (2024) analyzed a study sample of listed agribusiness companies from 2007-2021 to explore how government subsidies affect the progress of digital transformation in agribusiness.The study shows that the higher the government subsidy, the more favorable it is for agribusinesses to undergo digital transformation. Meanwhile, the higher the government subsidy, the more it can shorten the debt maturity structure, thus alleviating the problems such as insufficient funds brought by agribusinesses undergoing digital transformation[3].Liu Qiao (2024) studied the impact of digital transformation on the demand for agricultural talents, and based on the results of the study, formulated the agricultural talent training and introduction strategy for digital transformation, to meet the demand for agricultural talents in digital transformation, improve the efficiency and quality of agricultural digital transformation, and provide theoretical support and practical guidance for agricultural digital transformation [4].

Regarding the construction of ecological civilization, Chen Bin (2024) discussed that rural ecological civilization education is one of the key links in the construction of rural ecological civilization, playing a fundamental and pioneering role. It is of great significance for rural ecological civilization construction and rural ecological revitalization for farmers' main body to receive ecological civilization education. In the process of rural ecological civilization construction, it is necessary to give full play to the ecological value, cultural value and economic value of rural ecological civilization education[5].Zeng Fanqing (2024) studied the protection of rural ecological environment and the efficient use of natural ecological resources, which can not only ensure the stability of the ecological and economic system, guarantee the quality and safety of agricultural products, but also help to form a new pattern of development of green agriculture and highlight the advantages of ecological development[6].

However, most of the existing research focuses on a single field and lacks systematic studies on the synergistic promotion of rural revitalization by digital transformation and ecological civilization construction. This paper attempts to fill this research gap and explore the new path of rural revitalization under the synergy of digital transformation and ecological civilization construction.

2. Digital transformation and rural revitalization

2.1 Connotation and Characteristics of Digital Transformation

Digital transformation refers to the process of using digital technology to reshape production, life and governance. In rural revitalization, digital transformation is mainly reflected in the following aspects: First, digitalization of agricultural production: This involves the use of Internet of Things, big data and other technologies to achieve precision and intelligence in agricultural production. Second, digitalization of rural governance: This involves using digital platforms to improve the efficiency of

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rural governance and promote open government. Third, digitalization of rural services: This involves developing online education, telemedicine, etc., to improve the level of rural public services.

2.2 Impact of digital transformation on rural revitalization

2.2.1 Increased efficiency of agricultural production

The application of digital technology has significantly improved the efficiency of agricultural production. According to the data released by the Ministry of Agriculture and Rural Affairs in March 2023, the comprehensive mechanization rate of crop cultivation, planting and harvesting in China reached 72.93% in 2022, indicating a continuous improvement in the level of agricultural mechanization. The application of technologies such as smart farm machinery and the Internet of Things (IoT) in agriculture is driving the development of modern agricultural practices such as precision fertilizer application and smart irrigation. These practices are expected to further improve resource utilization.

2.2.2 Optimizing rural industrial structure

Digitalization has provided new opportunities for rural industrial development. The development of e-commerce has indeed helped the sale of agricultural products break through geographical restrictions and broadened the channels for farmers to increase their income. According to the China E-Commerce Report 2022 released by the Ministry of Commerce, the country's rural online retail sales reached 2.17 trillion yuan in 2022, a year-on-year increase of 3.6 percent. The application of digital technology is also promoting the development of new industries such as rural tourism and cultural creation, gradually enriching the shape of the rural economy.

2.2.3 Innovative rural governance models

Digital governance is improving the efficiency of village management. "Internet+Government Services" has enabled many farmers to conduct various affairs online, reducing the need to travel back and forth. For example, Zhejiang Province's "Zheli Office" APP is an important government service platform that provides a variety of online services to rural residents. According to Zhejiang provincial government data, by the end of 2022, "Zheli Office" had achieved full coverage at the county level, townships (streets), and 99.8 percent coverage in villages (communities). Meanwhile, big data analytics is providing new references for rural decision-making in some areas, with the potential to improve the precision of governance.

2.3 Challenges to digital transformation

Challenges to digital transformation: Although digital transformation brings opportunities for rural revitalization, it also faces a number of challenges: First, rural areas face inadequate digital infrastructure: insufficient network coverage in some remote areas restricts the application of digital technologies. Second, there is inadequate digital literacy among rural populations: some farmers, especially older ones, have limited ability to accept and use digital technologies. Third, the agricultural sector encounters data security issues: the collection and use of agricultural data may involve privacy and security concerns.

3. Ecological civilization construction and rural revitalization

3.1 Connotation and Characteristics of Ecological Civilization Construction

The construction of an ecological civilization is an important element of the cause of socialism with Chinese characteristics, and its embodiment in rural revitalization mainly includes: first, ecological environmental protection: protecting and repairing rural ecosystems and reducing environmental pollution. Second, green production methods: developing ecological agriculture and promoting environmentally friendly technologies. Third, ecological culture cultivation: cultivating farmers' ecological awareness and passing on rural ecological wisdom.

3.2 Impact of ecological civilization construction on rural revitalization

3.2.1 Improvement of rural habitat

The construction of ecological civilization is gradually improving the rural habitat. According to the

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Bulletin on China's Ecological and Environmental Conditions (2022) issued by the Ministry of Ecology and Environment, in 2022, the national rate of collecting, transporting and disposing of rural household garbage reached 93.1%, and the penetration rate of sanitary toilets in rural areas reached 74.1%. These figures reflect the continuous improvement of rural environmental sanitation conditions. At the same time, the initiative of constructing "beautiful villages" has promoted the improvement of the village environment in many places, helping to improve the quality of life of farmers.

3.2.2 Promoting green industry

The concept of ecological civilization is promoting the development of green industries in the countryside. The development of new industries such as organic agriculture and ecotourism has injected new vitality into the rural economy in some areas. In Sichuan Province, for example, according to data released by the Sichuan Provincial Department of Culture and Tourism, in 2022, Sichuan's rural tourism received 310 million visitors and realized a rural tourism revenue of 226 billion yuan. These figures reflect the positive role of ecotourism in promoting the employment and income of farmers.

3.2.3 Enhancing the soft power of rural culture

The building of an ecological civilization is promoting the inheritance and innovation of rural culture. By tapping into traditional ecological wisdom, many places are cultivating an ecological culture adapted to the new era. The "two mountains" concept (green water and green mountains are golden and silver mountains) in Anji County, Zhejiang Province, is a typical case in point.This concept was initially proposed by the Chinese President during his visit to Anji in 2005, and has now become an important concept in the construction of the country's ecological civilization. According to official data from Anji County, the county received 18.28 million tourists and realized 20.88 billion yuan in tourism revenue in 2022, reflecting the positive impact of the ecological and cultural brand on local development.

3.3 Challenges to the construction of an ecological civilization

The construction of ecological civilization also faces a number of challenges in the process of advancing: First, the balance between economic development and ecological protection: how to achieve economic development while protecting the ecology is a difficult problem for many regions. Second, the ecological compensation mechanism is imperfect: some ecological functional areas have lost development opportunities due to protection, but the compensation mechanism is not yet sound. Third, farmers' ecological awareness needs to be improved: the ecological awareness of some farmers is still insufficient, which affects the promotion of ecological civilization.

4. Paths for digital transformation and ecological civilization to synergize rural revitalization

4.1 Building a digital eco-agriculture system

First, we should develop smart agriculture. Utilizing technologies such as the Internet of Things (IoT) and big data, intelligent agricultural production systems should be established. For example, the development of intelligent irrigation systems that automatically adjust the amount of irrigation according to soil moisture, weather forecasts and other data has improved water use efficiency and reduced fertilizer loss, realizing a win-win situation in terms of production efficiency and ecological protection. Second, we should build a digitalized traceability system for agricultural products. Blockchain technology is being applied to build a farm-to-table traceability system for agricultural products. This application of technology has the potential to improve food safety and security and enhance consumer trust in green and organic agricultural products, thus potentially promoting ecological agriculture. In Guizhou province, for example, according to a report by the Guizhou Provincial Department of Agriculture and Rural Affairs, the province is actively promoting the construction of a traceability system for agricultural product quality and safety.

4.2 Promoting digital ecological governance

The first step is building a smart environmental protection platform. Environmental agencies should develop a platform that integrates pollution monitoring, early warning, and disposal systems. Through big data analysis, environmental agencies can achieve accurate identification of environmental issues and implement rapid responses. Second, we need to develop a digital ecological compensation mechanism. Utilizing big data technology, we should establish an ecological resource value assessment

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system to provide a scientific basis for compensation. Additionally, financial regulators should employ blockchain technology to ensure the transparent use of compensation funds. Third, we should innovate the digital participatory governance model. Local governments should develop a rural ecological governance app to encourage villagers' participation in environmental supervision and protection.

4.3 Fostering a digital eco-industry

Fostering a digital eco-industry: First, we should focus on the development of digital agriculture. We should promote precision agriculture technologies, such as satellite navigation seeding and drone-assisted crop spraying, to improve agricultural production efficiency while reducing resource waste and environmental pollution. Second, we should develop digital ecotourism. We should utilize virtual reality (VR), augmented reality (AR) and other technologies to create an immersive rural tourism experience. Furthermore, through big data analysis of tourist behavior, we aim to achieve rational allocation of tourism resources and scientific control of ecological pressure. Third, we should develop digitalized circular agriculture. Agricultural experts and technicians should use the Internet of Things and big data technology to build a system for resource utilization of agricultural waste. For example, local authorities should establish an information platform for agricultural straw collection, transportation and processing to promote the comprehensive utilization of crop residues.

4.4 Upgrading digital eco-services

Upgrading digital eco-services: First, we should focus on the development of intelligent medical care. Telemedicine technology should be utilized to solve the problem of insufficient medical resources in villages. Moreover, through big data analysis of health information, we can provide personalized health management services for rural residents. Second, we should promote smart education. We should provide quality education resources for rural students through online education platforms. In addition, using artificial intelligence technology, we can provide students with personalized learning programs. Third, we must build a digital cultural platform. Cultural preservation experts should utilize digital technology to protect and pass on rural cultural heritage, such as establishing digital museums and developing cultural heritage VR experiences. Furthermore, local cultural departments should promote rural culture through social media and other platforms to enhance cultural confidence.

5. Safeguards

5.1 Improving the policy support system

Improving the policy support system: First, governments should formulate digital village construction plans. They should formulate digital village construction plans that are in line with local realities, with clear objectives, tasks and implementation paths. Second, we should improve the ecological compensation policy. Policymakers should establish and improve the long-term mechanism of ecological compensation, and increase financial transfer payments to ecological functional areas. Third, we should formulate support policies for digital ecological industries. Local and national governments should introduce policies to support the development of digital agriculture, ecotourism and other emerging industries, such as providing tax incentives and financial support.

5.2 Strengthening infrastructure

First, local governments and telecom companies should promote the construction of rural information technology infrastructure. Local governments and telecom companies should accelerate the construction of new-generation information infrastructure such as 5G networks and the Internet of Things in rural areas. Second, we should improve the ecological monitoring network. Environmental protection agencies should build an ecological environment monitoring network with comprehensive coverage and high precision to provide data support for ecological protection decision-making. Third, we should build a digital service platform. Local authorities should build a comprehensive digital service platform integrating agricultural production, rural governance, public services and other functions.

5.3 Strengthening talent development

First, educational institutions should cultivate digital agriculture talents. Educational institutions

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should strengthen the construction of digital agriculture-related specialties in institutions of higher learning, and cultivate interdisciplinary talents who understand both agriculture and technology. Second, we should carry out farmers' digital skills training. Local agricultural departments should vigorously carry out farmers' digital skills training to improve farmers' ability to use digital technology. Third, we should introduce ecological environmental protection talents. Local governments should introduce ecological environmental protection professionals through various channels to provide intellectual support for the construction of rural ecological civilization.

5.4 Sound regulatory mechanisms

First, we should improve data security management. Relevant government departments should formulate standards and norms for the collection, use and sharing of agricultural and rural data, and safeguard data security and personal privacy. Second, we should strengthen environmental supervision. Environmental protection agencies should utilize big data, artificial intelligence and other technologies to improve the precision and effectiveness of ecological environment supervision. Third, we should establish a supervision mechanism with pluralistic participation. Government agencies should encourage the public to participate in the supervision of rural digitization and ecological civilization construction, and build a multi-party supervision system involving the government, enterprises and the public.

6. Conclusion

By analyzing the impact of digital transformation and ecological civilization construction on rural revitalization, this study proposes a path for digitalization and ecology to synergistically promote rural revitalization. The main conclusions are as follows: First, digital transformation and ecological civilization construction are two important driving forces to promote rural revitalization, and they promote and support each other. Second, digital transformation can improve the efficiency of agricultural production, optimize the rural industrial structure, innovate the rural governance model, and provide technical support for rural revitalization. Third, the construction of ecological civilization can help improve the rural habitat environment, promote the development of green industries, and enhance the soft strength of rural culture, providing ecological guarantee for rural revitalization. Fourth, the main paths of digitalization and ecological initiatives to synergistically promote rural revitalization include: building a digital ecological agricultural system, promoting digital ecological governance, cultivating digital ecological industries, and enhancing digital ecological services. Fifth, to realize the synergistic promotion of rural revitalization by digitalization and ecology, it is necessary to improve the policy support system, strengthen the infrastructure construction, enhance the training of talents, and improve the regulatory mechanism and other safeguard measures.

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