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Research on the Pathways and Mechanisms of Digital Intelligence-Driven Rural Revitalization: Based on the Practice of Future Rural Construction in Wenzhou

Hongjuan Lu

Wenzhou Polytechnic, Wenzhou 325000, China

Abstract: This article takes the practice of future rural construction in Wenzhou as an example, and combines field research, literature analysis, and case studies to explore the application effectiveness of digital technology in rural production, operation, governance, and services. Based on the Dynamic Capability Theory and Value Co-Creation Theory, a dual cycle coordinated development path for urban and rural revitalization driven by digital intelligence is proposed: internally promoting factor upgrading, industrial restructuring, governance optimization, and talent return, activating endogenous driving forces; Promote technology input, product output, data feedback, and service optimization to form a digital ecosystem for urban and rural areas. Emphasizing the stimulation of endogenous driving forces in rural areas, promoting collaborative creation among diverse entities, and supporting the guarantee of "infrastructure system training" to ensure the sustainability of long-term operation. Finally, it is proposed that data-driven rural revitalization should pay attention to differentiated positioning and implement tailored policies to stimulate endogenous driving forces; Digitization should match industry characteristics and promote multi regional joint construction and sharing; Suggestions such as adapting lightweight technology and improving villagers' digital literacy in a layered manner can provide practical references for rural revitalization and common prosperity.

Keywords: Digital technology, Future rural, Urban-rural dual circulation, Wenzhou model, Value Co-Creation.

1. Introduction

In 2024, China's No. 1 central document pointed out that to achieve Chinese path to modernization, we must continue to consolidate the agricultural foundation, strengthen the dual wheel drive of science and technology and reform, and effectively promote the comprehensive revitalization of rural areas. The comprehensive revitalization of rural areas requires addressing pain points and bottlenecks such as incomplete agricultural industry chains, weak supply chain competitiveness, talent loss in rural areas, aging and hollowing out of rural areas[1]. With the rapid development of the digital economy, digitization and intelligence have become endogenous driving forces for the comprehensive revitalization of rural areas. Accelerating the integration of digital technology with rural production, operation, governance, and services is not only an important measure to fill the gaps in the modernization of agriculture and rural areas, but also a key link to promoting high-quality and efficient rural areas, livable and business friendly rural areas, and prosperous farmers, and achieving comprehensive rural revitalization[1].

How digitalization can help rural revitalization, activate rural market vitality, eliminate urban-rural development gap, achieve regional integration and balanced development, and achieve common prosperity is currently a hot topic of discussion. The "future village" is a modern village in Chinese path to modernization, a major attempt to comprehensively promote rural revitalization in Zhejiang Province, and an application scenario and practice platform of digital intelligence technology in rural areas. It integrates beautiful countryside, digital countryside, humanistic countryside, good governance countryside, and shared prosperity countryside, leading the direction of rural development and serving as an ecological, production, and living community for achieving common prosperity. The first batch of 13 pilot projects in Wenzhou's future rural areas have been built, which are representative in multiple dimensions such as geography, economy, and culture. While retaining traditional rural characteristics, modern elements are integrated, making it an important practical case of digital technology driven rural revitalization.

This article conducts on-site research on the current situation of rural construction in Wenzhou, and explores in depth the implementation path and operational mechanism of digital technology driven rural revitalization, in order to provide new ideas and paths for the implementation of the national rural revitalization strategy, which has important theoretical and practical significance. This article focuses on exploring two major issues: firstly, how to construct a dual circulation path between urban and rural areas through digital technology in the future, stimulate the endogenous driving force of rural development, achieve coordinated development of urban and rural resources, and form a sustainable digital ecology; The second is how Wenzhou can effectively integrate digital intelligence technology to design operational mechanisms and implementation strategies for differentiated rural types.

2. Theoretical Framework of Data-driven Rural Revitalization

Rural revitalization strategy is an important part of Chinese path to modernization, which aims to promote agricultural and rural modernization and achieve coordinated development and common prosperity between urban and rural areas. Rural development is a systematic project, and technological support is the guarantee for the comprehensive implementation of rural revitalization. Digitization provides new impetus and paths[2]. Digitization refers to the integration

and application of digital technology and intelligent technology. It upgrades traditional production methods, management models, and lifestyles in all aspects through advanced information technologies such as big data, cloud computing, artificial intelligence, the Internet of Things, and blockchain, in order to promote comprehensive transformation and innovation in various fields such as economy, society, and culture[3].Research has shown that digital technology can promote rural economic transformation and upgrading through intelligent production, digital management, and innovative industrial integration[4];By integrating and sharing data resources through the platform, the transformation from single subject governance to diverse collaborative governance can be achieved, improving governance efficiency and stimulating the endogenous power and vitality of rural areas[5].

(1) The empowerment mode of digital intelligence technology in dynamic capabilities

" Empowerment "refers to the use of external forces to enable the recipient to acquire the power, resources, and capabilities necessary for development. This article explores how digital technology, guided by the government, empowers village collectives with the ability to increase income and impoverished households as vulnerable groups, providing internal vitality for independent poverty alleviation and sustained momentum for the steady advancement of rural revitalization strategies. This article mainly refers to technological empowerment based on digital intelligence technology, which empowers natural resources, farmers, rural industries, etc. The empowerment methods include factor empowerment, brand empowerment, industry chain empowerment, ecological empowerment, etc. The empowerment mechanisms are also diverse, providing a solid theoretical basis for in-depth exploration of the internal mechanism of digital intelligence empowering rural revitalization[6].

Dynamic capability refers to the ability of enterprises to integrate and build or rebuild internal and external competitiveness in order to adapt to rapid changes in the environment[6]. The rise and deep application of digital technology have brought new opportunities for rural revitalization, and its empowerment in dynamic capabilities is mainly reflected in integration, reconstruction, and optimization capabilities.

The integration capability includes three aspects: factor integration, industry integration, and resource integration. Digital technology enhances the aggregation ability of high-end factors, improves the efficiency of factor resource allocation, promotes the upgrading of production factor markets and changes in the business environment, and activates the vitality of rural resources[1].The reconstruction capability includes the reconstruction of three aspects: production mode, operation mode, and service mode. Digital intelligence technology builds a full chain agricultural digital ecology of production, supply, and marketing coordination for rural development[2]. The reconstruction capability includes the reconstruction of three aspects: production mode, operation mode, and service mode. Digital intelligence technology builds a full chain agricultural digital ecology of production, supply, and marketing coordination for rural development[4].

(2) The Implementation Path of Digital Intelligence Empowering Rural Revitalization under the Framework of Common Prosperity

The theory of value co-creation emphasizes that value is no longer created unilaterally by enterprises, but is generated through the interaction and cooperation of consumers, enterprises, and other stakeholders. The theory of value co creation in rural revitalization refers to the co creation of the agricultural product value chain by farmers, enterprises, technology platforms, and other entities. The co creation subject changes from "enterprise led" to "multi-party participation", and value is generated through experience and collaboration. Innovation is achieved by integrating multiple resources such as knowledge, technology, data, etc[6].Through the path of "co creation sharing mutual benefit" in technological innovation, digital technology fully leverages the roles of multiple entities such as enterprises, governments, research institutions, villagers, financial institutions, and cooperatives to form a value co creation system for technological innovation; Effectively utilizing digital technology and platforms to improve the value sharing ecosystem of technological innovation[7].

The innovation of digital technology is the fundamental guarantee for high-quality economic development. Economic development plays an important leading and supporting role in promoting common prosperity, which includes three levels: universal prosperity, comprehensive prosperity, and joint construction and prosperity[7]. This article proposes a triple implementation path of co creation, sharing, and mutual benefit for empowering rural revitalization with digital intelligence under the framework of common prosperity. On the one hand, through multi-party value co creation and sharing, wealth creation and resource optimization can be achieved, laying a solid foundation for the realization of common prosperity; On the other hand, through the shared benefits of sustainable economic, ecological, public service, and cultural values, a good layout for industrial co construction and green development is formed, generating social driving effects and promoting the process of common prosperity.

As a core competitiveness in market competition, digital technology empowers and leads economic development; In the process of economic development, by continuously adjusting the industrial structure through digital technology, improving the level of social productivity, optimizing resource allocation, preventing polarization, and achieving the goal of liberating and developing productivity, we can achieve common prosperity; At the same time, digital technology can promote economic development and encourage the government to continuously increase investment in scientific and technological innovation, thereby giving rise to more digital technologies in the process of achieving common prosperity[7].This article links digital intelligence technology with common prosperity through economic development, and further elaborates on the process of digital intelligence technology achieving co construction, gradual co prosperity, comprehensive prosperity, and common prosperity for all through the path of "co creation, sharing, and common benefit"[9].

3. The Implementation Path of Digital Intelligence Driven Rural Revitalization

In the process of promoting future rural construction in Wenzhou, digital technology has become a key link connecting urban and rural areas and activating rural development momentum. In the process of empowering rural revitalization with digital technology, a three in one linkage mechanism is formed by policy guidance, market drive, and social collaboration. Through digitalization of factors, industrial upgrading, and governance efficiency improvement, the quality and efficiency of rural internal circulation are promoted. Through technology going to the countryside, product going to the city, and data feedback, the integrated development of urban and rural external circulation is achieved. As shown in Figure 1.

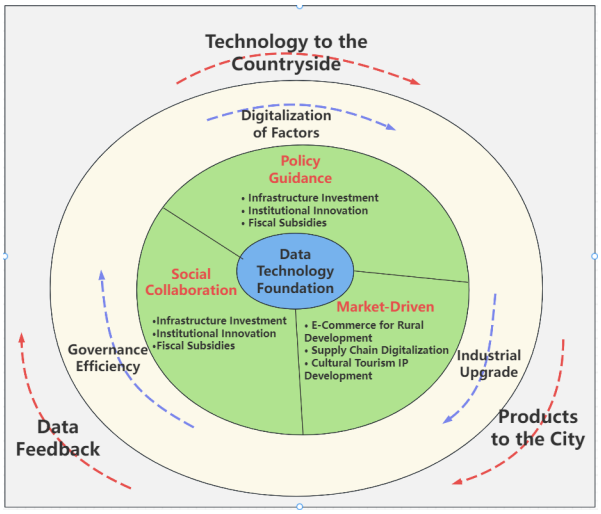

Figure 1. Sustainable Ecology of "Rural Supply - Urban Innovation - Dual Empowerment"

Through the use of digital technology to achieve dual circulation and synergy between urban and rural areas, Wenzhou has explored a distinctive path for rural revitalization in the future. Policy guidance is used to establish institutional frameworks, complete top-level design, and reduce barriers to urban-rural factor mobility through digital infrastructure investment, fiscal subsidies, and institutional innovation. Market driven to stimulate vitality, enterprises explore the value of rural resources through e-commerce to assist agriculture, cultural and tourism IP development, supply chain digitization and other models, forming a market-oriented closed loop of "technology going to the countryside - product entering the city - data feedback". Social collaboration gathers multiple forces, with universities and research institutions providing technical support, rural elites returning to their hometowns to start businesses driving talent and capital inflows, public welfare organizations assisting in digital skills training, and building a collaborative and shared ecosystem. This mechanism promotes the mutual promotion of rural internal circulation and urban-rural external circulation, ensures policy fairness, improves market efficiency, enhances social sustainability, and ultimately forms a new paradigm of rural revitalization with digital intelligence as the link and urban-rural value creation.

An endogenous cycle system of "factor upgrading industrial restructuring governance optimization talent return" has been formed within rural areas, relying on digital land ownership confirmation, intelligent transformation of agriculture, precise grid governance, and local digital talent construction to comprehensively activate the driving force of rural development. To create an interactive cycle mechanism of "urban technology input - rural product output - data value feedback - urban service optimization" outside the countryside, empowering rural industry development through the sinking of urban technology, connecting urban markets with rural characteristic cultural IP, feeding urban development with ecological data, and promoting civilization transmission through urban service optimization. Through effective linkage between urban and rural production and consumption, a digital ecosystem that empowers both urban and rural areas is constructed, achieving smart coexistence and gradually narrowing the urban-rural gap.

(1) Internal Circulation Path

Rural factor upgrading: integration of production factors and digital intelligence technology, including digital+labor as a new type of professional farmer, digital+capital as inclusive finance, digital+land as intelligent land transfer and use, digital+management as intelligent decision-making, etc[1]. The Yueqing government has established a digital skills training platform and remote education coverage to cultivate new farmers and achieve digitalization of human capital. For example, the "Tieding Fun" post-90s team in Xiashantou Village, Yueqing, has developed a research and study tour of Dendrobium officinale planting in Yandang Mountain using VR technology[8]. Yongjia Wolu Village utilizes satellite remote sensing and blockchain to realize the transfer of homestead and cultivated land rights, activate idle land resources, and achieve intelligent transfer and use of land resources. The "Mailang Park" and "Tianjia Mo Shang Yin Vacation Project" are typical applications of small fields turning into large fields, realizing intelligent production and digital management. Simplify inclusive finance, achieve credit evaluation and credit empowerment at the village level, and realize online capital flow. For example, Wencheng Rural Commercial Bank has developed "Entrepreneurial Credit Loans" for the contracted villagers of Wuyang Village's 10000 mu lotus pond. The government integrates agricultural, ecological, and population data to establish a rural data center, and each village establishes intelligent supply terminals such as WeChat mini programs to connect with urban demand, realizing data element assetization and intelligent management decision-making. For example, the "Hidden Wuyang" WeChat mini program in Wucheng Wuyang Village manages internal village affairs and interacts with external tourists[8].

Industrial restructuring and quality improvement: The integration of digitalization and intelligence in urban and rural industrial chains will be restructured from three aspects: digitalization of industrial clusters, digitalization of the entire agricultural industry chain, and digitalization of rural agriculture, culture, and tourism[1]. Through smart farmland and order agriculture, urban consumption data is directly connected to production bases to achieve C2M customization [2], realizing agricultural intelligence, such as the planting of flowers, fruits, and vegetables in Beitang Village, Yueqing. By digitizing agricultural product processing and sharing workshops, rural processing industrialization can be achieved, such as the bamboo industry in the Zeya Study Paper Mountain area of Ouhai[8]. Through VR village guidance and immersive experience of intangible cultural heritage, we aim to attract urban tourists to visit rural areas online[8], and create brand IPs such as the Liu Bowen culture and the "Jinshi Festival" in Wuyang Village, Wencheng. Through the

integration of rural complexes, health and wellness industries, and research and development industries, we aim to achieve innovation in the integration of the three industries, such as the Shihu Health Preservation and "Tieding Liuli" Rural Complex in Xiatou Village, Yueqing.

Governance optimization and efficiency improvement: Utilizing digital technology to achieve integrated government services, intelligent ecological governance, balanced public resources such as remote medical care and remote education, and precise security prevention and control[8]. For example, the Daming Tongbao Integral Intelligent Governance System in Wuyang Village, Wencheng, promotes the transformation of village "governance" to "intelligence". Attract people from the three urban townships to return home and start businesses, input human and capital resources into the rural system, achieve factor upgrading, and form a virtuous internal cycle, such as the participation of the three townships in the construction of their hometown in Wolu Village, Yongjia.

(2) External circulation path

Urban technology input activates the potential for rural development. Wenzhou's future rural areas actively introduce urban digital resources to promote the upgrading of traditional industries, such as Yitou Yiyang Village in Shanfu Town, Lucheng District, which relies on smart agricultural IoT technology to achieve precise management of Yangmei planting; Shangen Village in Chashan Street, Ouhai District has introduced a VR cultural and tourism system to create an immersive art village and attract young urban tourists; Xiashantou Village in Dajing Town, Yueqing City has collaborated with urban research institutions to develop digital cultivation of Dendrobium officinale and enhance product added value[11]. These technological inputs not only optimize the efficiency of rural industries, but also give rise to new business models, such as the Smart Farmland Research Base in Xuao District, Caocun Town, Rui'an City, and the Liu Bowen Cultural Digital IP in Wuyang Village, Nantian Town, Wencheng County.

Export rural products and reconstruct the urban-rural value chain. With the help of digital technology, the characteristic products and services of future rural areas in Wenzhou will enter a broader market, such as the Ou kiln cultural and creative products in Wolu Village, Fenglin Town, Yongjia County, which are sold nationwide through live streaming e-commerce; Siji pomelo from Zhongkui Village, Mazhan Town, Cangnan County, has entered high-end supermarkets relying on blockchain traceability technology; The homestay cluster in Yaoxi Village, Yaoxi Street, Longwan District has achieved a 30% increase in occupancy rate by intelligently matching the needs of urban tourists through OTA platforms[8]. Rural areas have upgraded from a single agricultural product supply area to cultural IP output areas, ecological service supply areas, and digital cultural tourism destinations, forming differentiated competitive advantages.

Data feedback optimization, smart coexistence between urban and rural areas. Rural data flows back to cities, promoting two-way service upgrades, such as the integration of marine environment monitoring data from Banping Community in Dongtou District into the urban ecological governance platform, to assist in the ecological protection of Wenzhou Bay; The smart health station data in Huyu Village, Kunyang Town, Pingyang County is connected to the Wenzhou Medical Big Data Center to optimize the hierarchical diagnosis and treatment system; The forest carbon sink data of Lingbei area in Taishun County has been included in the Wenzhou "Carbon Inclusive" trading market, providing carbon neutrality solutions for urban enterprises[11]. This data-driven urban-rural interaction makes rural areas the "green backyard" of sustainable urban development, and the technology and capital of the city in turn support the refined governance of rural areas.

(2) Digital Intelligence Link

The Digital Intelligence Link takes data flow as its core, breaks down the binary barriers between urban and rural areas, and builds a sustainable ecosystem of "rural supply urban innovation two-way empowerment"[9]. Through technologies such as the Internet of Things and big data, the ecological resources and characteristic products of rural areas are efficiently connected with the technology, capital, and consumption needs of cities. Urban digital solutions such as smart agriculture and digital cultural tourism activate rural industries, while rural ecological data and cultural IP feed back into urban green development such as carbon trading and cultural creativity. This bidirectional cycle not only enhances the value of rural areas, but also optimizes urban services, ultimately achieving a digital new pattern of urban-rural integration and symbiosis.

4. The Operational Mechanism of Data-driven Rural Revitalization

(1) Power mechanism

The driving mechanism for the future rural construction in Wenzhou is centered on "internal and external linkage, two-way empowerment". Through external assistance such as policy support and technology going to the countryside, it stimulates the endogenous development needs of villagers and the innovation vitality of village collectives, forming a sustainable driving model for rural revitalization. The key to this mechanism lies in adapting to local conditions and transforming external resources into endogenous driving forces. The external policy dividends and technological inputs are transformed through innovative training and cooperation models, gradually improving the digital literacy of villagers, and ultimately forming a virtuous cycle of "government promotion market response village leadership", injecting lasting momentum into rural revitalization.

In terms of endogenous power, the demand of villagers for digital life such as smart agriculture, e-commerce sales, and convenient government affairs, as well as the active exploration of industrial upgrading, rural civilization, and traditional cultural dissemination by village collectives, have become the fundamental forces for rural digital transformation. The promotion of local agricultural products, cultural and creative products, and other local specialties through live streaming sales in Wuyang Village, Wencheng, reflects a bottom-up innovation willingness. In terms of external driving forces, we rely on government policy guidance and private enterprise technology sinking to provide assistance. Wenzhou private capital actively participates in future rural construction, such as the Yueqing Beitang Modern Agricultural Park, which includes photovoltaic greenhouses built by Chint Group, the "Agricultural Cloud Platform" jointly built by Huawei, and the online brand "Beitang Fresh Fruit" jointly created by local e-commerce in Wenzhou, truly achieving a deep integration of "capital+technology+rural".

(2) Collaboration mechanism

This mechanism takes "government guidance, enterprise empowerment, village participation, and tourist interaction" as the value co creation path, breaks down urban-rural,

departmental, and regional barriers, builds a multi-party collaborative rural revitalization ecosystem, and forms a co construction and sharing ecosystem. In the practice of rural revitalization in Wenzhou, digital technology has become a key link in industrial collaboration, connecting the entire industry chain of agricultural production, processing, and sales through technological means such as the Internet of Things and big data, and achieving the integrated development of the three industries. In this process, the government provides institutional guarantees through policy support, while market mechanisms drive enterprises to connect their technological advantages with rural resources, forming a dual wheel driving model of "policy support and market performance", ultimately achieving a virtuous cycle of technological sinking, industrial upgrading, and win-win outcomes for all parties involved. The construction of the "Poetic Landscape, Blossoming Flowers on the Outskirt" rural revitalization demonstration belt in Fenglin Town, Yongjia County, through the transformation of Nanxi Greenway, with Guolu Village as the leading village for common prosperity, connects 9 major villages along the line, and carries out a major renovation and improvement of the village environment along the line, vigorously implementing the "Beautiful Countryside Construction Action". With the help of greenways, government guidance, and village collaboration, a large number of new industries and formats have been introduced. Nine major villages and communities share policies, passenger flow, technology, capital, and public services. This demonstration belt has driven more than 3000 employment opportunities for villagers, with an average annual income increase of more than 3200 yuan per capita. The collective economy of each village along the route has increased by more than 300000 yuan per year, injecting strong impetus into rural revitalization.

(3) Guarantee mechanism

In the process of digital driven rural revitalization, a sound guarantee system is the key support for sustainable development. In terms of policy guarantee, Wenzhou has issued special policies such as the "Action Plan for Digital Rural Development" to provide institutional basis for rural digital construction. In terms of capital investment, a digital special fund for rural revitalization will be established, and a central special lottery public welfare fund will be introduced. A diversified financing model of "financial guidance+social capital" will be adopted to focus on supporting the construction of new infrastructure such as 5G networks and IoT platforms, providing support for digital applications such as smart parking lots and smart garbage classification. In terms of digital skills training, relying on platforms such as "Rural Digital School" and online education, differentiated training is carried out for different groups such as village cadres and new professional farmers. Village cadres receive training in digital governance and decision-making, while new professional farmers mainly receive training in digital agriculture, live streaming e-commerce, etc., cultivating compound talents who understand both agriculture and digital technology. This guarantee mechanism, through the combination of software and hardware, not only solves the problem of weak rural digital infrastructure, but also enhances the digital literacy of construction entities, gradually bridging the urban-rural digital divide and providing sustained momentum for rural revitalization.

(4) Sustainable mechanism

This mechanism is centered around party building, empowering ecological protection, industrial upgrading, and people's livelihood improvement through digital technology, creating a sustainable development loop of "value co creation, achievement sharing, and benefit sharing", ensuring the long-term balance between digitalization and ecological, economic, and social benefits. In Wenzhou practice, through the "party building+digitalization" model, grassroots party organizations lead various entities to jointly participate in rural governance and industrial operation, which not only ensures the correctness of development direction, but also ensures the fair distribution of interests among all parties, ultimately achieving the organic unity of economic benefits, social benefits, and ecological benefits, injecting lasting impetus into rural revitalization. Wolu Village in Yongjia County adheres to the leadership of Party building in rural construction, solves problems such as dispersed forces and multi headed management, achieves systematic and coordinated promotion, and maximizes the internal driving force of common prosperity. Relying on 170 acres of Mailang Park, Gongfu Homestay Industry, Red Research Base and other projects, we provide services such as wheat planting, homestay services, cultural and tourism products, etc., driving surrounding farmers to activate more than 10 idle farmhouses and operate rural tourism. The average annual rental income per household alone is over 30000 yuan, providing more than 140 employment opportunities, and driving the village collective economic income to increase by more than 600000 yuan, and the villagers' income to increase by more than 20%. At the same time, a poverty alleviation fund pool will be established with 30% of the collective economic benefits of 40 villages in the town, specifically for assisting low-income farmers, truly building a "three life integration" community, and achieving green development and long-term operation.

5. Challenge and Suggestions

(1) Clarify rural development plans and differentiated positioning, actively return people from the three townships, and implement tailored policies to stimulate endogenous motivation

The homogenization and excessive commercialization of rural development result in poor sustainability and a lack of long-term operational mechanisms. Both Ouhaishan Root Village and Sanyang Wetland Old Street focus on cultural and creative coffee, and there are also Wutian Old Street and Qingdeng Market in the surrounding area. The foot traffic has been diluted, and the sustained effect of cultural and creative activities is not good. Many rural operations rely on social organizations, while third-party operating companies pursue short-term profits such as renting stalls and selling goods at high prices, neglecting the protection and inheritance of local culture, resulting in low tourist satisfaction and a decline in revisit rates and reputation, leading to a vicious cycle. The initial stage of rural development projects is lively, but in the later stage, they decline due to the lack of continuous content updates or industrial support, and there is a high risk of returning to poverty. A typical example is the "internet famous village" of Shangen Village, where the number of tourists has sharply decreased, shops have moved out, and gradually declined. The main reason for this is that Shangen Village's dominant culture is a music town, but the entire village's operation has not carried out the construction and support of IP brands, making it highly substitutable and difficult to sustain.

To solve the problem of long-term operation, in the top-

level design of rural development, emphasis should be placed on differentiated positioning. For example, Shangen Village can combine the resources of Ouhai University to provide conditions for attracting music creators to settle in nationwide, forming a music atmosphere and creating a brand IP for music art villages. Dongtou Island Village focuses on "ocean research and learning" to avoid homogeneous competition with inland villages.

(2) Rural digitization should match industrial characteristics, leverage economies of scale through contiguous construction, and promote multi regional joint construction and sharing

Wenzhou is mountainous and hilly, with small village sizes, fragmented arable land, limited agricultural scale, and long investment return cycles for infrastructure such as the Internet of Things and drones. The high cost sharing of technology applications has slowed down the progress of rural digital transformation. Wenzhou has abundant ecological resources, but low conversion value. Due to bottlenecks in industrial processing and the lack of industrial chain supporting facilities such as cold chain logistics in villages, digital technologies such as blockchain traceability are difficult to achieve economies of scale, which also limits the development of live streaming e-commerce. Blindly purchasing the same equipment in villages of the same type, such as multiple villages launching VR tourism, but with similar content, results in redundant construction waste.

To solve the problem of high technology application costs, promote regional joint construction and sharing, multiple adjacent villages jointly build a digital agriculture cloud platform, and small fields are transformed into large fields for combined planting to achieve economies of scale. Promote modular technology, flexibly configure equipment according to the size of villages, set up rural revitalization demonstration zones or belts led by the government, provide the foundation and possibility for contiguous construction, attract social capital for investment and construction, unify the procurement of smart equipment, and reduce single village costs.

(3) Carry out lightweight technology adaptation, promote aging friendly design, and enhance villagers' digital literacy in a layered manner

The significant digital divide between urban and rural areas, the vacancy of smart devices, the shortage of digital talents, and the low participation of villagers are the bottleneck problems in the digital transformation of rural areas. Some villages have high vacancy rates for equipment, and smart devices such as digital screens, AI monitoring systems, and grid warnings have become mere decorations due to their complex operation or lack of maintenance. The shortage of talent in the application of digital intelligence is prominent, with young and middle-aged people from rural areas leaving, a lack of local technical operation and maintenance personnel, and low acceptance of digital tools by left behind elderly and women, which greatly reduces the management effectiveness of digital intelligence platforms. The training is merely a formality, and the digital training content is disconnected from the actual needs of villagers, resulting in low acceptance.

Addressing the digital divide between urban and rural areas, implementing lightweight technology adaptation, promoting aging friendly designs such as voice interaction and one click alarm .Cultivate local talents and establish the position of "Rural Digital Steward", with local returning youth or village cadres working part-time and receiving subsidies from the government. Implement demand oriented training, improve villagers' digital literacy in layers, and carry out training for villagers' actual pain points, such as teaching farmers to use Tiktok to sell goods live, rather than theoretical courses.

6. Conclusion

Digital technology is an accelerator for rural revitalization, but it needs to be deeply integrated with local needs. The common path of digital technology driving rural revitalization is based on the framework of urban-rural dual cycle coordinated development, promoting the endogenous cycle of "factor upgrading industry reconstruction governance optimization talent return" internally, and consolidating the foundation of rural development through land digitization, agricultural intelligence, grid governance precision, and local talent cultivation; To build an interactive cycle of "urban technology input - rural product output - data value feedback - urban service optimization" externally, activate industries through technology sinking, connect markets with characteristic products, and feedback urban development with ecological data, forming a sustainable ecology of "rural supply - urban innovation - dual empowerment". This path emphasizes lightweight and modular technological adaptability, achieves economic feasibility through regional joint construction to reduce costs, relies on villagers' joint governance to prevent poverty relapse and achieve sustainable governance, providing universal development logic for various rural areas.

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