"Balancing Cultural and Martial Arts Revitalization · Living Rejuvenation"Research on the Path of Digital Empowerment for Optimizing the Human Settlements of Traditional Villages

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ABSTRACT

This paper centers on the concept of "Balancing Cultural and Martial Arts Revitalization · Living Rejuvenation" to explore a multidimensional approach to digitally enhance human settlements optimization of traditional villages. On the basis of describing the current state of digital empowerment in the development of human settlements of traditional villages, it analyzes the current problems in the development of human settlements of traditional villages from four aspects: insufficient application of digital technologies, deficiency in regional cultural representation, imbalance in village architectural landscape, and inadequate policy implementation. Building on this analysis, this research proposes four optimization paths: Technological empowerment to create interactive spatial experiences of Daliangjiang's digital empowerment in human settlements of traditional villages; Delving into regional culture to build a digital and visual cultural heritage database; Restoring village landscapes to create a living open-air museum of Ming-Qing architecture; Activating policy systems to build a digital implementation guarantee for the human settlements of traditional villages. These strategies aim to integrate digital technologies deeply into the design of human settlements, forming a localized optimization path that offers theoretical and practical guidance for the sustainable development of traditional villages.

Keywords: Balancing cultural and martial arts revitalization, living rejuvenation, digital empowerment, traditional villages, human settlement optimization

1. Research Overview

In 2019, the General Office of the Communist Party of China Central Committee and the State Council jointly issued the Digital Rural Development Strategy Outline, updated in 2024, which identifies traditional villages as a priority for digital preservation. The policy mandates "the creation of 'digital heritage resource libraries' and 'digital museums' for historic and cultural towns, villages and traditional villages" to promoting the digitalization of excellent cultural resources in rural areas. It proposes that the framework system of digital villages will be initially established by 2025, and the cultural resources of traditional villages will be fully presented and shared by the whole people by 2035, which provides a good policy environment and opportunities for the development of digital empowerment in traditional villages.

Daliangjiang Village was founded in the late Yuan and early Ming dynasties, initially named "Gantao Village". During the Wanli period of the Ming dynasty, with the migration of the Liang family from Pingding County, Shanxi, it gradually developed into the main surname in the village and was later renamed "Daliangjia". Due to its location deep in the Taihang Mountains and water scarcity, the village was later

renamed "Daliangjiang" because the villagers were eager for water. As historically part of Shanxi's Pingding Prefecture, it was transferred to Hebei's Jingxing County in 1959, retaining strong Shanxi cultural influences. In 2010, Daliangjiang was designated as one of the fifth batch of National Historic and Cultural Villages. In 2016, it was awarded the title of "China's Most Beautiful Ancient Village". As a living heritage of culture of Shanxi merchants and Taihang Mountain stone architecture, the village currently has 162 Ming and Qing Dynasty ancient courtyards, 314 quadrangle courtyards, and a total of more than 3000 houses. Among them, the most representative is the "Wukui Courtyard", also known as one house and nine courtyards. In recent years, relying on the Taihang Sky Road self driving route, it has become an important tourist destination around Shijiazhuang, with a low degree of commercialization and still maintaining its original ecological style.

This paper takes the Daliangjiang as the research object, based on the concept of "Balancing Cultural and Martial Arts Revitalization · Living Rejuvenation", and deeply reflects on the essence of traditional village preservation. "Balancing Cultural and Martial Arts Revitalization" refers to the systematic inheritance of cultural genes, the restoration and rejuvenation of space, technological empowerment, and other material level innovations; "Living Rejuvenation" is the construction of a dialogue mechanism between traditional regional culture and modern life through digital technology, making villages no longer museum like specimens, but interactive life forms. Based on this, combined with 3D modeling, VR/AR and other technologies, it clarifies the optimization path of human settlements of traditional villages and provides a three-dimensional collaborative solution for digital empowerment of traditional villages.

2.Analysis of Core Issues in Digital Empowerment for Human Settlements of Traditional Villages in Daliangjiang under the Concept of "Balancing Cultural and Martial Arts Revitalization · Living Rejuvenation"

(1) Insufficient Application of Digital Technologies

In 2023, Daliangjiang Village in Jingxing County was designated as one of Shijiazhuang City's first batch of "Digital Twin Traditional Village" pilot units. However, the overall construction progress has been slow, with insufficient application of digital technologies, mainly manifested in the following two aspects:

① Monotonous Forms of Architectural Digital Archiving

Currently, Daliangjiang has conducted data collection for some ancient architectures, but the overall progress remains sluggish. Only one-third of the core area's architectures have been documented, and the data formats are singular - primarily limited to drawings and textual descriptions. There is a lack of high-precision 3D models constructed using 3D laser scanning technology, making it difficult to comprehensively and accurately represent the complex spatial structures of ancient architecture and the unique craftsmanship of brick/wood carvings. Consequently, this fails to provide complete and detailed data references for architectural restoration.

② Low Level of Digital Tourism Services

Online tourism platforms' introductions to Daliangjiang Village remain at basic textual descriptions with few static images, lacking interactive digital services such as VR panoramic tours or intelligent audio guides. tourists cannot immerse themselves in the village's landscape through online platforms, nor can they easily access detailed cultural explanations or navigation services during tours. This diminishes tourist experience, results in underutilized tourism resources, and fails to fully leverage digital technology's empowering effect on the tourism industry.

(2) Deficiency in Regional Cultural Representation

① Convergent Narrative Logic and Dilution of Core Values

The current digital dissemination of Daliangjiang Village remains formulaic. In tourism promotional materials such as videos, the representation of "Shanxi-Hebei Merchant Culture" is superficial, limited to geographical markers like "ancient trade route relics" and "mule-and-horse post stations," while failing to explore deeper institutional aspects such as merchant guild

organizations. This reduces cultural presentation to a hollow accumulation of symbols. On network platforms, content about Daliangjiang Village primarily focuses on "photo spots" and "trendy homestays," where the spiritual essence of traditional culture becomes diluted by entertainment-oriented approaches, making it difficult to establish a distinctive cultural IP.

② Homogenized Commercial Development and Erosion of Cultural Ecology

The current commercial landscape in Daliangjiang Village exhibits a high degree of homogeneity. Local cultural products predominantly consist of generic items like keychains and refrigerator magnets, demonstrating a lack of innovation. Even in the village's numerous digital homestays - the most prevalent commercial development - only standardized smart devices are offered, failing to provide any meaningful digital interpretation of traditional residential culture. This superficial development model has reduced Daliangjiang Village to a "cultural shell" that neither satisfies tourists' demands for profound cultural experiences nor sustains local cultural identity.

(3) Imbalance in Village Architectural Landscape

Due to prolonged lack of maintenance, partial collapse has occurred in some residential architectures within the village. Meanwhile, certain newly constructed residential architectures and homestays have incorporated glass curtain walls and reinforced concrete structures that abruptly interrupt the traditional architectural clusters. These incompatible interventions have disrupted the original skyline and spatial rhythm of streets and alleys, not only diminishing the village's aesthetic value but also eroding the cultural memory embedded in traditional spaces. Considering these developmental challenges currently facing Daliangjiang Village, optimizing its digital empowerment for human settlements of traditional villages has become an urgent priority requiring immediate reinforcement.

(4)Inadequate Policy Implementation

At the policy execution level, several issues persist including unclear departmental responsibilities and insufficient inter-agency coordination. While Daliangjiang's digital development requires collaborative implementation across multiple departments (culture and tourism, science and technology, finance, etc.), effective inter-departmental communication mechanisms remain unestablished in practice. Concurrently, the absence of systematic training for grassroots implementers has resulted in superficial understanding of digital cultural industry support policies and digital talent certification standards among some staff members, leading to deviations during policy implementation. Compounded by the lack of incentive mechanisms, these factors have dampened implementers' motivation to drive policy enforcement, further exacerbating the ineffectiveness of policy systems.

3.Optimization Path of Digital Empowerment for Human Settlements of Traditional Villages in Daliangjiang under the Concept of "Dual Cultivation · Living Revitalization"

(1) Technological Empowerment to Create Interactive Spatial Experiences of Daliangjiang's digital empowerment in human settlements of traditional villages

① Creating an Immersive Interactive Tour System Centered on Tourist Experience Needs

In Daliangjiang Village's digital transformation, spatial computing technology has been employed to convert a 2,000-square-meter core preservation area into an interactive "living museum." Moving beyond the traditional static information displays in scenic spots, the project adopts a design concept of "exploratory learning". At the former residence of the military examination champion, tourists can use gesture recognition to "pick up" virtual weapons, with the system instantly displaying the historical context and usage techniques of each weapon. These designs transform cultural knowledge into operable interactive elements, making the learning process both natural and engaging. Technically, the system integrates multimodal interaction technologies combining gesture recognition, voice interaction, and eye-tracking to ensure tourists of all ages can find suitable interaction methods.

② Innovating the "Memory Puzzle" Feature to Address Cultural Preservation Needs

The project invites village elders to share their life stories. These oral histories, when systematically documented and combined with archival photographs and historical artifacts, are transformed into interactive videos. Younger generations can "time-travel" across different eras by swiping their screens, witnessing how ancestral homes once appeared while listening to firsthand accounts of bygone lifestyles. This "Memory Puzzle" functionality not only safeguards invaluable collective memories but also fosters spontaneous cultural identification among youth as they trace the village's historical trajectory.

(2) Delving into Regional Culture to Build a Digital and Visual Cultural Heritage Database

In terms of architectural culture, the research emphasizes decoding cultural genes through multispectral scanning technology applied to the "Wu Kui Courtyard." Surface analysis revealed systematic masonry variations in the masonry of walls with different orientations: Northern walls employ “herringbone patterns” for wind resistance, Southern walls feature “well-type arrangements" for enhanced ventilation. These architectural lexicons have been translated into parametric models, forming an "Architectural Craftsmanship Database".

In terms of folk culture: Centered around the ancient scholar tree at the village entrance, a Blessing Square has been established. This space hosts regular Daliangjiang cultural festivals featuring: Intangible cultural heritage practitioners demonstrating folk arts such as interactive performances of ritual ceremonies ("Kai Suo Er"), paper-cutting ("La Hua"), and folk processions ("She Huo"), thus forming "Folk Culture Memory Bank" .

(3)Restoring Village Landscapes to Create a Living Open-Air Museum of Ming-Qing Architecture

Daliangjiang preserves 162 Ming-Qing architectural clusters with five distinct enclosure typologies: single-wing enclosure, double-wing enclosure, triple-wing enclosure, quadrilateral enclosure, and hybrid configurations. The most representative architecture is the "Wu Kui Courtyard" (Military Examination Champion's Compound), built during the Qianlong era. It consists of nine courtyards that are interconnected but independent, forming a layout of architectures within the courtyards and courtyards within the architectures, representing Shijiazhuang's best-preserved, largest-scale, and most architecturally significant historic residence.

Following the restoration principle of "authenticity and repairing the old as the old" to restore the village's landscapes, a quality assessment of the Ming-Qing architectural clusters in Daliangjiang Village is conducted. By using UAV photography and 3D laser scanning technology, carpet-style data collection is carried out on village architectures, automatically identifying architecture elements that conflict with traditional styles, generating visualized heat maps of style conflicts, and customizing a restoration plan for each architecture based on style conflict elements. During the renovation process, the concept of "flexible renovation" is applied to the color steel roof architectures that must be preserved. Grey tile patterned color steel plates and antique coatings are used for appearance renovation; The BIM technology is used in idle architectures to design the scheme of adding traditional sloping roofs, which can restore the visual effect of local architectures in Daliangjiang while maintaining the safety of modern structures, and create a digital living open-air museum of traditional villages.

(4)Activating Policy Systems to Build a Digital Implementation Guarantee for the Human Settlements of Traditional Villages

① Activating Land Resource Activation Policies

Establish a dynamic database of idle homesteads and housing resources in the Daliangjiang ancient village, and comprehensively survey the status of idle assets in the village. Formulate the Management Measures for the Circulation of Idle Homesteads and Houses in Daliangjiang Village, clarifying the circulation procedures and income distribution mechanisms. Allow villagers to transfer idle resources to professional cultural tourism enterprises or cooperatives for long-term leasing and other forms through the village collective platform, for the construction of characteristic homestays, cultural studios, etc. The circulation income shall be distributed to villagers, village collectives, and operators in a certain proportion to activate land resources.

② Compiling Technical Standards for Ancient

Architecture Restoration

Collaborate with ancient architecture research institutions and traditional craftsmen to compile the Code for Construction Techniques of Daliangjiang Villager Residences, covering multiple traditional craft standards such as masonry of brick - stone foundations and woodcarving techniques. Digitally archive each ancient architecture through 3D modeling and VR/AR technologies to provide precise data support for restoration work, ensuring compliance with the principles of "authenticity and repairing the old as the old".

③ Cultivating Digital Cultural Heritage Talents

At the basic education level, encourage primary and secondary schools in the village to offer "Digital Cultural Heritage" courses, through which students can learn about the Ming and Qing traditional architectural knowledge of their living village. At the higher education level, cooperate with local universities and cultural technology enterprises to develop characteristic courses on "Digital Activation of Traditional Villages", set up core courses such as 3D Modeling and Digital Restoration of Ancient Villages and Intangible Cultural Heritage, integrate regional cultural elements of Daliangjiang, enable students to master digital scanning technologies, and independently complete the construction of Daliangjiang's digital archives.

4. Conclusion

This research takes Daliangjiang Village as the research object, and systematically explores the innovative path of digital empowerment for optimizing the human settlements of traditional villages under the concept of "Balancing Cultural and Martial Arts Revitalization · Living Rejuvenation". By constructing a four-in-one collaborative framework of "technical empowerment-delving into regional culture-restoring village landscapes-activating policy systems", the multiple dilemmas of traditional village preservation and development can be effectively addressed. The important value of this research lies in: firstly, it puts forward a systematic solution to the digital empowerment of traditional villages; Second, the methods of "memory puzzle" and "folk culture memory bank" are proposed to provide reference for similar contexts; Third, the innovative policy model has reference significance for perfecting the traditional village protection system and providing theoretical reference for researchers in related fields.

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