

Research on the Integration Path of Digital Intelligence Empowerment for Jingxing Red Cultural Tourism and Rural Revitalization

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ABSTRACT

In the context of the digital economy era, digital intelligence technologies have provided innovative pathways for the revitalization of revolutionary old districts. This study takes Jingxing County in Hebei Province as the research object, focusing on the digital integration mechanism between red cultural tourism resources and rural revitalization. Through field surveys, the research explores innovative models of digital intelligence technology empowerment for county-level development. The research reveals that Jingxing County, leveraging 23 red heritage sites including the Hundred Regiments Campaign Memorial Sites, has constructed a "Digital Twin Platform for Red Resources" to achieve 3D modeling and cloud-based cultural data storage of these sites. By utilizing big data to analyze tourist behavior patterns, the county has developed an intelligent "Red Education + Ecological Agriculture" guided tour system to extend tourist stay duration. Blockchain technology has also been adopted to establish an agricultural product traceability system, driving the formation of a distinctive agricultural industrial chain across eight surrounding townships. The research proposes a "Four-Dimensional Integration" development framework: coordinated digital infrastructure and heritage preservation, intelligent cultural and tourism services, IP-oriented cultural dissemination, and platform-based industrial synergy. This exploration of a "red-green integration" model based on digital intelligence technologies addresses challenges such as seasonal fluctuations and short industrial chains in traditional red cultural tourism. It provides a replicable solution for revitalizing cultural resources and promoting industrial transformation in revolutionary old districts. This research offers valuable references for the sustainable development of similar regions and contributes theoretical and practical insights to digital rural construction.

Keywords: Digital intelligence empowerment; Rural revitalization; Jingxing red cultural tourism and culture

1. Introduction

As the main battlefield of the Hundred Regiments Campaign, Jingxing County in Hebei Province boasts 23 significant red heritage sites and abundant natural ecological resources. Revolutionary old districts like Jingxing are often underdeveloped, making their comprehensive rural revitalization both politically symbolic and instrumental in driving similar regions toward prosperity. Under China's strategic goal of

achieving common prosperity through modernization, these areas must pursue leapfrog, high-quality development. Red is the profound heritage of its culture; Green is the bright color of its development. The "red" cultural heritage and "green" ecological resources form the foundation for a "red-green integration" development model. By integrating digital intelligence technologies, this model explores innovative pathways for cultural preservation and industrial upgrading. Aligning with national policies and local practices, this

study systematically investigates the synergy between red cultural tourism and rural revitalization in Jingxing, aiming to provide replicable experiences for comparable regions.

2. Current Status and Challenges of Jingxing Red Cultural Tourism and Rural Revitalization

(1) Resource Endowment and Policy Support

Jingxing County has formed a "red + green + ancient" integrated tourism landscape, anchored by the Hundred Regiments Campaign sites, ancient villages, and Taihang Mountain ecosystems. With 242 revolutionary villages, over 100 heritage sites, and 12 municipal-level patriotic education bases, Jingxing County is the core area of Taihang Mountain revolutionary old base area, which is rich in red cultural heritage.

In recent years, the county has implemented the "2+4+23+1000" red cultural project to systematically integrate resources to build red education bases, red lines, beautiful red courtyards, and create tourism brands like "Jingxing Red." For example, Honghecao Village combines its Hundred Regiments Campaign Memorial Hall with the Honghe Canyon rafting project, attracting tourists and driving villagers to increase their income, generating daily tourism revenue of over ¥1,000. In addition, traditional village reserves have adopted models like "red-themed education + cultural tourism integration + livestream e-commerce" to foster new industries and integrate production with village development. Agricultural-culture-tourism integration has diversified the industrial system. For example, Jiazhuang Town connects characteristic agricultural parks in series with all-season tourist routes such as "enjoying flowers in spring and Liangshan in summer". In 2024, it received more than 600,000 tourists, driving the annual output value of agricultural and sideline products such as chrysanthemum and *Toona sinensis* to exceed 10 million yuan. At the same time, the establishment of e-commerce live broadcast base and local IP matrix has realized the online and offline dual-track operation of handicrafts and agricultural products, broadened sales channels and promoted employment. This kind of practice

shows that red cultural resources are being transformed into economic kinetic energy through the mode of "red+ecology+industry".

At present, the development of Jingxing red cultural tourism has significantly enhanced the vitality of rural economy. Honghecao village improves the income structure of villagers through drifting projects and red education bases; Zhangjiajing village cooperates with village enterprises by revitalizing idle resources to enhance the "hematopoietic" function of the collective economy. On the social level, the combination of red cultural project and civilized practice activities in the new era has strengthened the construction of rural civilization, such as "Farmers Harvest Festival" and "Color Weekend", and promoted cultural identity and social governance. In 2025, the No.1 Document of the Central Committee emphasized "promoting the deep integration of rural culture and tourism", carrying out the pilot project of rural revitalization with cultural industries, improving the level of rural tourism's characteristics, quality and standardization, and providing policy support for digital intelligence to empower Jingxing red cultural tourism and promote comprehensive rural revitalization.

(2) Existing Problems

① Homogeneous Resources and Weak Brand Influence

Despite rich red cultural resources, development remains reliant on conventional tourism and museum displays, lacking differentiated experiences. Compared to regions like Chongqing and Yan'an, which use VR, AR, and red-themed escape rooms to engage younger audiences, Jingxing lags in immersive digital applications, diminishing market competitiveness.

② Superficial Industrial Integration

The integration of agriculture, culture and tourism is still manifested in the development of primary products, with limited value chain extension. For instance, Jiazhuang Town's chrysanthemum-derived products (e.g., essential oils and masks) show market potential but lack scale and brand recognition. Synergy between red cultural tourism and emerging sectors like study tours and wellness tourism is underdeveloped, hindering a "multi-

industry symbiosis" ecosystem.

③ Infrastructure and Talent Gaps

Inadequate transportation and accommodations in rural areas restrict tourist capacity. While Zhangjiaying Village has established an e-commerce base, supporting services remain incomplete. A shortage of skilled professionals further undermines project sustainability due to weak planning and marketing capabilities.

④ Conflict Between Cultural Preservation and Development

How to balance protection and utilization is an urgent problem in the development of red sites. For example, Honghecao Village's rafting project boosts local income but risks diluting the educational value of red heritage due to excessive commercialization. In addition, traditional village renovations also risk homogenization, threatening historical authenticity.

3. Innovative Pathways Enabled by Digital Intelligence Technologies

(1) Digital Infrastructure and Resource Activation

In order to effectively protect and inherit the red resources in Jingxing, building a "digital twin platform for red heritage" has become the primary task. Through high-precision 3D modeling technology, the platform digitally restores the site group of Hundred Regiments Campaign and realizes the cloud data management of the site group. Based on successful digital protection projects at home and abroad, such as the digital project of Dunhuang Mogao Grottoes, through high-precision scanning and three-dimensional reconstruction, not only the digital preservation of cultural relics is realized, but also the viewing experience of tourists is improved. Jingxing can learn from this kind of experience, further improve the digital twin system of red sites, and lay a solid foundation for the subsequent immersive experience and educational communication.

On the basis of digital protection, the introduction of AR/VR technology can enhance the immersive experience of tourists. By developing "time-travel" scenes, such as simulating the war environment of Hundred Regiments Campaign, tourists can play a specific

role in the virtual world and feel the heroic integrity of the martyrs personally. This interactive experience can not only enhance the emotional resonance of tourists, but also effectively enhance the communication effect of red culture. Taking the VR air raid defense project in Zhenwang Township of Qingtian as an example, it successfully attracted a large number of tourists through highly realistic virtual scenes and interactive experiences. Jingxing can learn from this model and design virtual tourist routes such as "Revisiting Hundred Regiments Campaign" and "Hero Guayun Mountain", so that tourists can shuttle between virtual and reality and deeply appreciate the charm of red culture.

(2) Intelligent Cultural Tourism Services and Industrial Synergy

The application of digital intelligence technology lies not only in the protection and display of resources, but also in improving the intelligent level of cultural tourism services and promoting the deep integration and synergy between industries. Through GIS spatial analysis and tourist behavior data, the county can accurately grasp the preferences and needs of tourists, and then optimize the red tourist routes and navigation systems. For example, Jingxing can develop a composite tour guide system of "Red Education+Ecological Agriculture", organically combine the red ruins with the surrounding ecological agricultural resources, prolong the stay of tourists and enhance the depth and breadth of tourism experience. With reference to Linze County, the development of "Geology+Red" program has successfully promoted the growth of local tourism income, with an increase of 45.39%. Jingxing can learn from this model, combine its own red resources and ecological agriculture characteristics, and create composite tourism products with local characteristics to meet the diversified needs of tourists.

Blockchain technology can play an important role in the linkage between red tourism and agricultural industry. By establishing the blockchain traceability system of Jingxing walnut, pepper and other characteristic agricultural products, the whole life cycle management of agricultural products can be realized and the quality and

safety of products can be ensured. At the same time, the synergy e-commerce platform realizes direct connection between production and marketing, reduces intermediate links and enhances the market competitiveness of agricultural products. The reference case is Zhejiang's "advertising to help agriculture" model, which successfully promoted the sales of agricultural products through live broadcast incubation base and regional brand marketing, with an annual output value exceeding ¥230 million. Jingxing can learn from this model, improve the transparency and credibility of agricultural products by using blockchain technology, and promote the branding and internationalization of agricultural products by combining emerging marketing methods such as e-commerce platform and live delivery.

(3) IP-Driven Branding and Communication Innovation

Focusing on the Hundred Regiments Campaign, the county designs cultural and creative products with local characteristics, such as red theme blind boxes and digital souvenirs (such as NFT virtual medals), to attract the attention and participation of young customers. Apply big data to analyze the "digital intelligence" communication flow code of red resources, especially rural red resources, innovate discourse expression, increase efforts to support self-media to join the communication subject matrix, integrate rural ecological resources and characteristic traditional culture in old areas and spread them, and promote the development of rural cultural tourism in old areas. These cultural and creative products not only have collection value, but also can expand the influence of red culture through the sharing and dissemination of social media. Through the mode of "cultural travel IP + immersion experience", Dunhuang's "Music in Motion", as a successful example, has successfully created a cultural brand with local characteristics, attracting the attention of a large number of tourists and consumers. Jingxing can learn from this model, develop red-themed light and shadow shows and non-legacy courses, closely combine red culture with local characteristics, and create a unique cultural IP.

At the same time, short video platforms (such as

Douyin and Kuaishou) and other new media channels are used to spread red stories and regional characteristics, so as to enhance the popularity and reputation of Jingxing. The joint universities make micro-documentaries, dig deep into the connotation and value of red culture, shape sub-brands such as "Jingxing Kiln" and "Ancient Village Homestays", and form the communication effect of all-media matrix. Through the promotion and dissemination of new media, many regions at home and abroad have successfully enhanced the visibility and attractiveness of the region. For example, the spread of Old Town of Lijiang through the short video platform has attracted a large number of tourists' attention and visits. Jingxing can learn from this kind of experience and make use of the wide coverage and efficient communication characteristics of new media to expand the international influence and attraction of red culture.

The application and innovation path of digital intelligence technology in the field of red cultural tourism is multi-dimensional and all-round. By constructing digital infrastructure, improving the intelligent level of cultural tourism services, and implementing strategies such as brand IP and communication innovation, Jingxing can not only effectively protect and activate red resources, but also promote the transformation, upgrading and sustainable development of regional economy.

4. Practical Mechanisms and Outcomes of Integrated Development

(1) "Four-Dimensional Integration" Framework

① Coordinated Digital Infrastructure: As the cornerstone of integrated development, the collaborative construction of digital infrastructure is the primary task. Jingxing actively improves the coverage of 5G network, which not only improves the speed and quality of information transmission, but also provides a solid foundation for the development of emerging formats such as smart agriculture and smart tourism. The application of intelligent agricultural facilities, such as intelligent irrigation system and remote monitoring of pests and diseases, has effectively improved agricultural production efficiency and resource utilization. At the same time,

the digital transformation of transportation system, such as intelligent traffic management system and electronic navigation service, has greatly facilitated tourists' travel and improved the intelligent level of scenic service. In addition, the digital transformation of scenic spot services, such as online reservation, electronic ticketing, intelligent tour guide and other functions, not only optimizes the tourist experience, but also effectively relieves the pressure of people flow during the tourist season.

② Scenario-Based Tourism Services: In terms of improving the tourist experience, Jingxing has developed an AR (Augmented Reality) guided tour and AI (Artificial Intelligence) personalized explanation system by drawing lessons from advanced domestic and foreign cultural tourism service modes, such as the dynamic explanation mode of Mogao Grottoes, and combining with local characteristics. The application of these technologies not only enriches the tourist experience, but also deepens the tourists' understanding and memory of Jingxing red culture and natural landscape through interactive and informative explanations. In addition, through big data analysis of tourists' behavior preferences, customized travel information is pushed, which further improves the accuracy and satisfaction of services .

③ IP-Oriented Cultural Dissemination: Jingxing is rich in red cultural resources and intangible cultural heritage, such as the traditional firing technology of Jingxing kiln and the production technology of Hupizhuang Tianxia Taiping Lantern. By combining these cultural resources with digital technology to create a cultural IP with local characteristics, it not only enhances tourists' sense of cultural participation and experience, but also effectively promotes cultural inheritance and innovation. For example, develop online cultural courses, virtual reality experience halls, etc., so that tourists can learn through interaction and feel the charm of traditional culture. At the same time, use new media channels such as social media and short video platforms to expand the influence of cultural IP and attract the attention and participation of more young people.

④ Platform-Based Industrial Linkage: In order to realize the deep integration of red cultural tourism and

rural revitalization, Jingxing actively builds e-commerce and digital financial platforms, and integrates the resources of the whole industry chain such as production, logistics and sales. E-commerce platform provides a broader market for local agricultural products, while digital finance reduces the financing costs of small and micro enterprises and farmers and promotes the efficient circulation of funds. In addition, through data analysis, accurately meet the market demand, guide agricultural production to develop in the direction of high quality and characteristics, and improve the added value of agricultural products.

(2) In-depth Analysis of Case Studies and Data Validation

In order to verify the effectiveness of the "four-dimensional integration" development framework, this paper selects two typical cases in Jingxing for in-depth analysis, and shows how digital technology can empower the integrated development of red cultural tourism and rural revitalization through specific data and results.

① Waterside Town Project: Relying on its unique natural scenery and red cultural resources, a town in Jingxing has built a tourism brand of "waterside town". The project makes full use of digital marketing means, such as live-streaming sales and short video promotion, which effectively broadens the sales channels of tourism products. According to statistics, after the implementation of the project, the collective economic income of the town has rapidly increased from ¥21,000 to ¥200,000, achieving a qualitative leap. Live-streaming sales not only directly promoted the sales of local agricultural products, but also enhanced the popularity and attractiveness of the town through live interaction, attracting a large number of tourists to experience. The contents such as travel strategy and beautiful scenery sharing on the short video platform further stimulated tourists' willingness to travel and formed a good word-of-mouth effect.

② Blockchain Agricultural Industry Chain: Jingxing actively explores the application of blockchain technology in agricultural industrial chain, and effectively improves the quality and safety of agricultural products by building a transparent and traceable agricultural

product supply chain system. The application of this technology not only led to the formation of distinctive agricultural industries in eight towns, such as special fruit cultivation and organic vegetable cultivation, but also promoted the standardized production of agricultural industries. According to statistics, the annual output value of these characteristic industries has exceeded ¥230 million and the standardized productivity has reached 85%. Blockchain technology ensures that the data of every link of agricultural products from production to sales is true and reliable, enhances the trust of consumers, and also provides strong support for the brand building of agricultural products. In addition, through the blockchain platform, farmers can obtain market information more conveniently, adjust planting structure and improve economic benefits.

5. Challenges and Recommendations

(1) Enhance Technological and Cultural Innovation: Driven by Technology, Reshape Red Tourism Experience

In the development process of red cultural tourism, the combination of technological empowerment and cultural innovation is the key to enhance attraction and competitiveness. Specifically, the introduction of virtual reality (VR) and augmented reality (AR) technology can not only create an immersive experience project, but also deeply explore the connotation of red culture and present it to tourists in a more vivid and intuitive way. In the experience architecture of virtual space, technology and body are not simple technology access, but can mobilize complex emotions with two-way interaction, reconciliation and correction. The digital media in the virtual space can stimulate multiple sensory functions to the greatest extent, bringing about “an emotional empathy experience” between people and works. For example, by using VR technology to reproduce historical scenes, let tourists "experience" revolutionary historical events, or develop an interactive game with a red theme, and integrate historical stories into the puzzle solving process. This novel interactive form can especially attract young customers and stimulate their interest and desire to explore red culture.

In addition, drawing on the successful model of "design-driven rural revitalization" in Pinggu District, Beijing, the county can invite professional design teams to carry out fashion transformation of red culture IP to enhance its market appeal and communication power. This includes, but is not limited to, designing red cultural and creative products with regional characteristics, and creating a red scenic spot identification system with distinctive themes, so as to enhance the recognition and memory of tourists. Through the integration of design thinking, red culture is no longer a static historical display, but a bridge connecting the past and the present, tradition and modernity.

(2) Deepen Industrial and Regional Collaboration: Construct Diversified Industrial Ecology and Promote Regional Coordinated Development

Deepening the coordination between industry consolidation and the region is another important strategy for the sustainable development of red cultural tourism. On the one hand, we should promote the intensive processing of agricultural products and the development of cultural and creative products to form a "red+intangible+ecological" composite industrial chain. This will not only help to enhance the added value of agricultural products, but also broaden the economic income channels of red tourism through the design and sales of cultural and creative products. For example, combining the local intangible cultural heritage, developing characteristic handicrafts with red elements, or integrating red stories into the packaging design of agricultural products, so as to realize the dual value-added of culture and economy.

On the other hand, the county should strengthen cross-regional cooperation, integrate red resources in neighboring areas, and jointly build cross-provincial tourist routes. Taking the Shanxi-Hebei-Shandong-Henan border region as an example, the region is rich in red historical sites and stories. Through joint development, a red tourism boutique route integrating education, leisure and sightseeing can be built. This mode of cooperation can not only share resources and send tourists to each other, but also promote cultural exchanges and economic

cooperation between regions and form a mutually beneficial and win-win development pattern.

(3) Improve Infrastructure and Talent Mechanism: Consolidate Foundation of Development and Strengthen Support of Talents

The improvement of infrastructure and the construction of talent mechanism are the cornerstones of the development of red cultural tourism. The government should increase financial input, give priority to improving key facilities such as transportation and accommodation, and enhance the convenience and comfort of tourism services. At the same time, a "red cultural tourism talent pool" is established, and a group of compound talents who understand red culture and have professional operation ability is cultivated through school-enterprise cooperation and directional training. The market-oriented management experience of Chongqing 1949 Grand Theatre provides a good example. By introducing a professional management team, the whole chain optimization from content creation to marketing is realized, which greatly enhances the attraction and influence of the project.

In order to train the red cultural tourism talents more systematically, Jingxing cooperated with universities to build a sketch base and a "Red Cultural Tourism Research Institute", which not only undertakes the task of cultivating talents, but also should become a highland for the study of red culture. Through the establishment of special training courses such as research planners and digital technicians, combined with practical projects, the county will cultivate compound talents who understand both culture and technology, and provide a solid talent guarantee for the high-quality development of red cultural tourism.

(4) Establish Sustainable Development Mechanisms: Balance Preservation and Commercialization, Explore Public-private Financing Models

The construction of data resources is the key to the expected role of digital intelligence empowerment and an effective measure to help rural revitalization . Aiming at the main challenges of the shortage of digital talents and limited capital investment, it is particularly important to establish a collaborative mechanism between

government and enterprises. The government can attract more enterprises to invest in red cultural tourism projects through inclusive finance policies, such as providing low-interest loans, tax relief and other preferential measures. At the same time, the implementation of talent cultivation plan needs to be closely combined with market demand to ensure that the trained talents can effectively serve the industrial development.

6. Conclusion and Outlook

Jingxing County not only enriches the cultural connotation of red tourism, but also enhances the sense of experience and participation of tourists, thus effectively extending the time span of tourist peak season and weakening the influence of seasonal fluctuations on red tourism. Digital intelligence can conform to the strategic direction of the development of the digital age, provide personalized solutions for different needs, reflect the new connotation and new characteristics of smart agriculture, and become an inevitable choice for China's agricultural development in the new era . The application of digital intelligence technology can also promote the extension and expansion of the red tourism industrial chain, drive the development of related agricultural industries, and realize the diversification and coordinated upgrading of the industrial chain.

In order to further promote the deep integration of red resources and digital economy, Jingxing County needs to continue to deepen policy support, actively respond to relevant policy requirements such as the No.1 Document of the Central Committee in 2025, and provide a solid policy guarantee for the application of digital intelligence technology in the field of red tourism. In addition, Jingxing County should also learn from successful cases, such as Zhejiang's "advertising to help agriculture" model, and continuously enhance the popularity and influence of red tourism through cross-regional cooperation and international communication. On this basis, Jingxing County provides a set of "reproducible and scalable" models for the construction of digital villages, contributing an important force to promoting the overall revitalization of the countryside.

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