

“Bridging the Moon with Numbers, Creating Yongle with Wisdom”: Smart Technology-Driven Rural Tourism Landscape Planning - A Case Study of Yongle Village, Dongxi Town, Qijiang District

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Abstract: This study proposes solutions to address issues such as the lack of distinctive culture, inadequate architectural protection, insufficient experiential landscapes, and cultural forgetting in Yongle Village, Dongxi Town, Qijiang District. Relying on the landscape pattern of “little bridges, flowing streams, and households” and the Bayu stilted building complex in Yongle Village, the study aims to facilitate rural industrial upgrading and inject new vitality into rural revitalization through “digitalization + smart agriculture.” By integrating cutting-edge technologies such as digital twins, AI, and the Internet of Things, the study constructs a system of “one brain (rural wisdom brain) and three networks (cultural perception network, ecological monitoring network, and industrial service network)” to achieve “digital cultural tourism applications + smart agriculture applications + ecological protection applications” and promote the deep integration of traditional village protection and modern technology. The study strives to create a new smart tourism model that integrates “technology empowering nostalgia, ecology, countryside, healthcare, and cultural tourism,” providing a replicable and promotable example for rural revitalization.

Keywords: Technology empowered; Countryside; Ecology; Cultural tourism

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1. Introduction

1.1. Project background

As evident from relevant documents such as the “Beautiful Village Construction Guidelines” GB32000-2015, “Overall Planning of National Land Space in Chongqing (2021-2035)”, “District Planning of National Land Space in Qijiang, Chongqing (2021-2035)”, and “High-standard Farmland Construction Planning in Chongqing (2021-

2030)”, tourism is a highly information-intensive and information-dependent industry. Information permeates the entire process of tourism activities and is the foundation for the survival and development of the tourism industry^[1]. The impact of informatization on tourism development is increasingly profound, and the level of tourism informatization has become one of the important indicators of the development level of tourism destinations.

Simultaneously, with the rapid development of global tourism and continuous technological advancements, tourist demands are gradually shifting from traditional scenic spot visits to more personalized, interactive, and intelligent services. As a product of the deep integration of tourism and information technology, smart tourism has become an important force driving the transformation and upgrading of the tourism industry. Yongle Village, Dongxi Town, Qijiang District, Chongqing, is located in a scenic area with a rich cultural heritage and abundant internal and external resources, providing unique conditions for the development of smart tourism.

1.2. Design purpose

1.2.1. Achieving organic integration of technology and humanities

The innovative pathways for combining digital technology with traditional village protection was the core design objective of this project. Through intelligent technological means such as the Internet of Things, AR/VR, and digital twins, the project was aimed to activate Yongle Village’s cultural heritage and natural ecological resources in a “light intervention, micro-transformation” manner. This approach has been suggested to avoid damaging the village’s original texture due to technology application and achieves the sustainable development goal of “technology empowering nostalgia.”

1.2.2. Constructing a new industrial model integrating agriculture, tourism, and culture

The homogenization dilemma of traditional rural tourism was the aim of this project. By utilizing a smart agriculture monitoring system, the output value of farmland was enhanced. In combination with digital cultural tourism products such as AR navigation and intangible cultural heritage workshops, an experience economy that formed a three-in-one industrial chain of “agricultural production-cultural experience-ecological tourism was created. A sustainable and self-sustaining business model for rural revitalization was provided.

1.2.3. Innovating the way of living cultural inheritance

Addressing the issue of rural cultural discontinuity, a cultural inheritance scene through digital technology was constructed in this project. The blockchain to preserve intangible cultural heritage skills was used, and AI was utilized to generate interactive print paintings, and immersive farming theaters was involved. These efforts had enabled younger generations to understand traditions through contemporary language, facilitating the creative transformation and innovative development of cultural heritages like Qijiang farmer print paintings and ancient farming methods.

1.2.4. Establishing an ecological smart management system

Balancing ecological protection and economic development was focused on in the design. By deploying an environmental sensor network, it was continuously monitored water quality, soil, and biodiversity data. This data was then converted into environmentally friendly games that tourists could participate in, such as an “ecological bank” points system. The environmental protection from government regulation was shifted in this approach to promote awareness to all citizens.

1.2.5. Providing a lightweight model for rural revitalization

A rural transformation pathway of “small team + appropriate technology” was validated in the project. Through the low-cost integration of technologies (such as offline AR and solar-powered IoT devices) by a 4-person interdisciplinary team, a replicable digital transformation solution for resource-limited villages was provided. This has demonstrated how to achieve maximum benefits with minimal intervention.

1.3. Design significance

1.3.1. Promoting the deep integration of agriculture and intelligence, creating a new paradigm of smart agriculture

A traditional agriculture was upgraded in this project into a visual, interactive, and learnable smart agriculture system through technologies like IoT monitoring, AI data analysis, and AR interactive experiences. For example, a QR code could be scanned to view crop growth status and even participate in virtual farming games. This “production + experience + science popularization” model not only improves agricultural production efficiency but also adds touristic value to farmland, promoting the integrated development of primary, secondary, and tertiary industries.

1.3.2. Preserving and inheriting rural cultural heritage, activating new life for intangible cultural heritage

Addressing the issue of rural cultural discontinuity, digital was adopted in the project adopts to preserve and revitalize the intangible cultural heritage resources of Yongle Village. For instance, with AR Qijiang print paintings; to watch the printmaking process and engage in DIY creation, tourists could scan with their phones. These innovative approaches brought traditional culture to life and pass it down, enhancing rural cultural confidence.

1.3.3. Promoting the popularization of ecological environmental protection awareness and building a green smart village

The project has created environmental protection concepts deeply rooted in people’s hearts through ecological monitoring networks and gamified interactions. For example, the “Biodiversity Bank” allows tourists to take photos and identify plants and animals, earning ecological points to redeem rewards. This “data visualization + public participation” model was transformed an abstract concept into a perceivable and actionable way of life.

1.3.4. Promoting rural revitalization and development, exploring sustainable paths to prosperity

The project not only enhances the tourist attraction of Yongle Village but also drives income growth for villagers through digital means, forming a virtuous cycle of “cultural tourism attracting visitors - agricultural value-adding - shared prosperity for villagers,” providing a sustainable model for rural revitalization ^[2].

1.3.5. Providing new smart agriculture and learning methods, driving innovation in science education

The limitations of traditional agricultural exhibitions, creating a smart science popularization system that is “playable, learnable, and shareable” was broke through the project. A research and practice base was provided in this “experiential learning”, which not only attracts family tourists for primary and secondary school students, pushing agricultural science popularization towards being more interesting and modern.

2. Market analysis

2.1. Location analysis

Yongle Village, Dongxi Town, Qijiang District, is located in the southeast direction of Chongqing's main city, approximately 15 kilometers away from the Qijiang urban area. It is situated in the golden transition zone between Chongqing and Guizhou, with significant locational advantages. The village is adjacent to the Chongqing-Guizhou Expressway and National Highway 210, with a 1.5 hours' drive to the main urban area of Chongqing, providing convenient transportation. Additionally, it neighbors Dongxi Ancient Town, a national historic and cultural site, allowing it to share its mature tourist resources. The village is situated along the banks of a tributary of the Qi River, surrounded by mountains and water, featuring typical Bashu mountainous settlement landscapes and well-preserved Ming and Qing dynasty hanging buildings. It possesses both the charm of a Jiangnan water town with "little bridges, flowing waters, and households" and the three-dimensional spatial characteristics of a mountainous village. This unique "suburban and ancient-modern fusion" location not only provides rich cultural and ecological resources for the development of rural tourism but also effectively meets the demand for leisure tourism in the Chongqing metropolitan area, giving it inherent advantages for the development of smart cultural tourism and ecological agriculture.

2.2. Natural conditions analysis

The region is located on the southeastern edge of the Sichuan Basin and has a typical subtropical humid monsoon climate, with an average annual temperature of 18.2 °C. It experiences abundant rainfall and distinct seasons. The village is built near mountains and rivers, with a topography mainly consisting of shallow hills ranging from 300-500 meters in elevation. A tributary of the Qi River flows through the village, forming a natural "two mountains and a valley" landscape. The vegetation coverage rate in the area is over 65%, dominated by subtropical evergreen broad-leaved forests. The surrounding area features diverse ecosystems such as terraced fields, bamboo forests, and streams. The soil is primarily purple soil and paddy soil, suitable for crop growth. This organic integration of "mountains, water, fields, and forests" not only constitutes a rich landscape resource but also provides superior environmental conditions for the development of ecological agriculture and rural tourism. Additionally, the moderate climate ensures a suitable tourism period of up to 10 months throughout the year.

2.3. Analysis of cultural resources

The area boasts a profound cultural heritage and unique folklore resources. Its cultural characteristics are mainly reflected in three aspects: Firstly, the well-preserved traditional architectural complex of Bayu, represented by the stilt houses from the Ming and Qing dynasties, whose layout following the contours of the mountains demonstrates the architectural wisdom of "harmony between nature and humanity"; secondly, the rich intangible cultural heritage, including the living cultural inheritance such as Qijiang farmer printmaking, traditional farming techniques, and folk mountain songs; thirdly, as an important node on the branch line of the Ancient Tea Horse Road, there are remains of the ancient road and memories of commercial culture. These cultural resources are organically integrated with the natural landscape of "small bridges and flowing streams" in the village, forming a unique style of "landscape as the form and culture as the soul". Among them, farmer printmaking has been listed in the Intangible Cultural Heritage of Chongqing, providing a high-quality cultural IP for the development of cultural and tourism integration. The village still retains traditional farming customs such as the 24 solar terms and folk activities such as the "New Harvest Festival", constituting a complete rural cultural ecosystem of Bayu.

2.4. Visual analysis

In terms of visuals, the area presents a visually rich and geographically distinctive landscape system: The village follows the contours of the mountains, and the cascading stilt house complex, terraced fields, bamboo forests, and streams form a vertical landscape belt of “houses-terraced fields-mountain forests”, creating a highly rhythmic three-dimensional picture. The visual focus is concentrated on the winding bluestone ancient road through the village and the century-old wind and rain corridor bridge spanning the stream, where the mottled wooden frames and gurgling streams form a delightful contrast.

In summary, the region has superior comprehensive conditions for developing rural tourism. It is located close to the main city of Chongqing with convenient transportation, which can effectively meet the demand for urban leisure; it has an ecological base that integrates “mountains-water-fields-forests” with a pleasant climate and long suitable tourism period; it preserves intact cultural resources such as the Bayu stilt house complex, Qijiang farmer printmaking and other intangible skills, as well as traditional farming culture, which constitute unique selling points; and its visually cascading three-dimensional space and changing pastoral colors throughout the seasons form a strong attraction. These resource endowments highly align with the growing demand for short-distance eco-cultural tourism and immersive experiences among the urban population in Chongqing. Furthermore, the innovative application of digital technology can further enhance product differentiation and competitiveness, making the project have significant development potential and competitive advantages in the rural tourism market of the Chengdu-Chongqing region.

3. Design principles

3.1. Experiential landscape as the developmental feature

The traditional static viewing mode was broken through in the design and a participative and experiential living landscape was created through immersive interactive technology and multi-sensory experience design. Based on preserving the village’s original spatial texture, interactive nodes such as AR virtual scenes, intelligent commentary systems, and farming experience areas will be implanted, enabling visitors to “touch history, experience farming, and perceive ecology.” A touring system of “one step, one scene, one experience” has been formed, allowing the landscape to become a medium connecting people and culture.

3.2. Non-material cultural heritage features as auxiliary means

A dual-track strategy of digital activation and scenarized reproduction was adopted to innovatively transform intangible cultural heritage resources such as Qijiang printmaking and traditional crafts. An intangible cultural heritage AR experience hall was established, and a DIY digital workshop was developed, festival exhibition activities was planned, the intangible cultural heritage was shifted from static display to dynamic participation. Simultaneously, blockchain technology was utilized to establish a digital archive, ensuring the authenticity and sustainability of cultural inheritance.

3.3. Cultural education as the basic goal

The educational function of “learning while touring” was emphasized in this project, and a local education system was constructed covering all age groups. For children, there were nature observation trails and farming tool experience areas. For teenagers, there were STEM courses on seasonal farming. For adult visitors, A cultural decoding guidance system was provided. Through hierarchical and interesting knowledge output, the dual goals of

cultural dissemination and value delivery were achieved.

3.4. Countryside practice as the core requirement

Adhering to the concept of “farmland is the classroom,” the agricultural production spaces was transformed into educational practice places in this design. A participative smart farmland demonstration area was planned, where visitors claimed plots through an app, crop growth was monitored, and the entire process from seeding to harvesting was experienced. Additionally, a traditional farming experience area was set up, traditional skills like cow farming and manual harvesting was preserved, a three-dimensional scene of ancient and modern farming dialogue was created.

3.5. Safe development as the core criterion

A three-level safety guarantee system was established in this design: physically, the traditional village disaster prevention layout (such as building sites selected for mountain and flood avoidance) was retained; technically, the lightning protection and moisture-proof IoT devices was adopted; and operationally, the emergency plans and digital monitoring systems was planned. All interactive devices have passed safety certification, and children’s activity areas are designed with soft pavement and no sharp corners, ensuring a safe experience for visitors of all ages.

3.6. Adaptation to local conditions as the basic premise

Following the principle of “light intervention and micro-renovation,” all construction was based on existing terrain and architectural texture. Smart devices are wireless and solar-powered, reducing pipeline excavation. Local bamboo, wood, and stone materials was used in landscape sketches. The farming experience area was divided based on the original field layout, minimizing disturbance to natural ecology and village scenery, achieving harmonious coexistence between technology implantation and the local countryside.

4. Design analysis

4.1. Overview of design concept

The core design philosophy of “Enabling Nostalgia with Technology, Revitalizing Tradition with Wisdom” was adhered in this project. Through the approach of “digital weaving,” modern technology was organically integrated into the natural and cultural fabric of Yongle Village^[3]. Supported by the “One Brain, Three Networks” smart system, a landscape system that integrates “production, ecology, and lifestyle” was constructed, achieving immersive inheritance of intangible cultural heritage, innovative transformation of agricultural resources, and intelligent protection of the ecological environment. Ultimately, this project has aimed to create a rural revitalization demonstration model that combines the local characteristics of Bayu with the features of the digital age.

4.2. Analysis of design

A “double helix” structure was adopted in the design: longitudinally, the technical path of “cultural decoding - spatial translation - technology implantation - operational activation” was followed to complete the entire process design from resource sorting to product implementation; horizontally, the spatial strategy of “core detonation - axis series connection - regional coordination” was employed to form a three-dimensional layout of “smart hub + themed loop + functional clusters.” The focus was on grasping the adaptability of traditional space to modern

functions and the balance between digital experience and cultural depth, ensuring that every design decision is technically feasible and culturally reasonable.

4.3. Axis analysis

An experience axis network was constructed in the plan of “one main axis and three sub-axes”: the main axis followed the ancient path and stream to form a “cultural traceability axis,” connecting key nodes such as the digital intangible cultural heritage museum and the AR wind and rain bridge; the sub-axes include the “ecological exploration axis” (mountain forest trail + smart monitoring station), the “farming experience axis” (terraced field theater + agricultural innovation workshop), and the “rural life axis” (renovated guesthouses + digital fireplace). The axes were interconnected through a smart navigation system, forming a thematically distinct and mutually permeable tourism route system that guides visitors through a deep experience from natural cognition to cultural resonance.

5. Business model design

5.1. Self-selection digital cultural tourism products

A series of technological and cultural innovation products with local characteristics was created, mainly including:

- (1) Augmented Reality Art Creation Kits (containing traditional printmaking materials and online interactive programs)
- (2) Technology-enabled Agricultural and Sideline Product Kits (equipped with a full traceability system)
- (3) Digital Collection Certificates (with unique digital asset value)

Establish a three-dimensional sales network of “Internet Platform + Automatic Vending Terminals”, set up popular price gradients to facilitate quick on-site ordering by tourists, and optimize the efficiency of the purchasing process.

5.2. Interactive experience service projects

A participatory tourism consumption system was established, focusing on the development of:

- (1) Cloud Farm Trusteeship Services (annual subscription, providing basic planting monitoring)
- (2) Traditional Handmade Experience Courses (appointment-based participatory teaching)
- (3) Special Accommodation Combination Products (dynamic pricing system)

Implement a “membership fee + personalized service” charging method. For example, farm members can purchase virtual planting advisor services to cultivate stable customer relationships[4].

5.3. Education-integrated service solutions

The knowledge popularization tourism products were developed, including:

- (1) Off-campus practical teaching combinations (virtual agricultural experience + outdoor practical guidance)
- (2) Parent-child nature cognition activities (using interactive games on smart devices)
- (3) Digital skills improvement courses for educators

Adopt an institution cooperation and profit-sharing mechanism to achieve revenue overlay from bulk purchases and individual consumption, while building a teaching user database.

5.4. Social responsibility practice plan

A new model combining business and public welfare was created:

- (1) Digital protection projects for traditional skills (with partial revenue dedicated to skill inheritance)
- (2) Online promotion platform for agricultural products (waiving platform fees for producers)
- (3) Environmental protection and cultural innovation development plan (innovative use of traditional agricultural tools)

Establish a public welfare behavior reward mechanism where participants can obtain exclusive tourism rights through volunteer service or public welfare consumption, promoting a sustainable public welfare model.

6. Technical implementation

6.1. Project features

6.1.1. Excellent geographic location

The project was conducted in Yongle Village, Dongxi Town, Qijiang District, which was located at the junction of Chongqing and Guizhou provinces. With only a 1.5 hours' drive from the main urban area of Chongqing, providing convenient transportation and a wide radiation range for the customer market. Nestled between mountains and rivers, and adjacent to the nationally renowned historical and cultural town of Dongxi Ancient Town, the village not only shared mature tourism facilities but also retained the original style of the Bashu mountainous region, forming a composite location advantage of “suburban recreation + cultural immersion” and providing natural conditions for the development of short-distance depth tours.

6.1.2. Deep cultural heritage

The project was rooted in the well-preserved Ming and Qing dynasties hanging footbridges and Chongqing farmer's print, which are provincial intangible cultural heritages in Yongle Village. Through digital twin technology, the traditional mortise and tenon structure of the buildings was precisely recorded, and AR interaction is used to visualize the printmaking skills. Special scenes such as the “Digital Fire Pit” and “Solar Term Farming Theater” were designed to transform intangible cultures such as oral history and folk songs into experiential and transmittable live resources, building an inheritance system where “architecture was read and culture was touched.”

6.1.3. Diversified educational experience

An innovative design covers an educational matrix for all ages, including an “AR Nature Detective” exploration game for children, STEM farming laboratories for teenagers, and intangible cultural heritage digital workshops for adult tourists. Through visualized farmland sensor data and traditional farming tool experience zones, immersive learning is achieved where “the field is the classroom, and the farming tools are the teaching aids,” meeting differentiated needs such as study tours, family and children's activities, and silver-haired education.

6.1.4. Sustainable development

A “low-impact development” technical strategy was adopted. All smart devices are wireless and were powered by solar energy. Digital exhibition halls were transformed from abandoned farmhouses, preserving 80% of the original farmland texture. A “Village Digital Cooperative” operating model was established, training locals to serve as AR content reviewers and sensor maintainers, ensuring that the project's later operation did not rely on

external teams and forming a triple sustainable mechanism of economy, ecology, and society.

6.1.5. Digital intelligence empowerment innovation

A “cultural gene intelligent matching algorithm” was utilized, where building restoration plans were automatically generated through machine learning. An “ecological data storytelling engine” has been developed to transform real-time monitoring data into AR narrative content. In particular, a UGC crowdsourcing platform has been constructed where tourist-created digital prints and farming animations, after review, the official system was integrated and a continuously growing “digital cultural gene bank” was formed by upgrading the paradigm of technology application from unilateral output to co-creation.

6.2. Innovation points

6.2.1. New applications of digital cultural tourism, and new inheritance of old culture

In response to the national strategy on cultural digitization and rural cultural revitalization policies, An entry point was taken by digital cultural tourism in the project, that was further integrated with regional cultural elements, and rural historical and cultural heritage was inherited.

6.2.2. New applications of smart agriculture, keeping pace with the times

A “cloud-edge-end” collaborative smart agriculture system was innovatively constructed, cutting-edge technologies such as 5G, AI, and blockchain was deeply integrated, and a new smart tourism model of “technology empowering nostalgia” was created.

6.2.3. New applications of intelligent monitoring, and new green ecological protection

In the project construction, environmentally friendly and energy-saving technologies such as solar power generation systems and rainwater collection and utilization systems were adopted to reduce the consumption of natural resources. At the same time, intelligent monitoring and data cloud platforms were utilized to create a green and sustainable rural tourism landscape.

6.2.4. Rural “digital-smart” tourism landscape promotes development

This project was aimed to create a “cultural-ecological-smart” collaborative development model that aligns with the requirements of industrial integration development in the national rural revitalization strategy. By developing rural tourism and agriculture, it promoted local economic growth, increases farmers’ income, promoted the prosperity of rural industries and affluent living, and provided strong support for comprehensive rural revitalization.

7. Summary

This project, with Yongle Village, Dongxi Town, Qijiang District, Chongqing as the carrier, has created a demonstration model of technology-empowered rural revitalization through the innovative integration of “digital cultural tourism + smart agriculture + ecological protection”. The project has fully utilized Yongle Village’s ecological advantages of “mountain-water-field-forest” integration, well-preserved Bayu architectural complexes, and intangible cultural heritage resources. By applying cutting-edge technologies such as digital twins, AR/VR, and the Internet of Things, a “one-brain, three-networks” smart system has been constructed, realizing the digital

transformation of traditional villages. In spatial planning, a three-dimensional network of “cultural traceability axis + ecological exploration axis + farming experience axis” has been formed, and characteristic products such as intangible cultural heritage AR activation, smart farmland monitoring, and ecological data gamification have been developed, which not only preserve the authenticity of the village but also created an immersive new experience ^[5]. Through the technical strategy of “light intervention and micro-renovation” and the operation mode of “villagers’ digital cooperatives”, the project has explored a sustainable path of cultural inheritance, ecological protection, and industrial revitalization, providing replicable and promotable practical experience for the digital construction of similar villages and vividly interpreting the core concept of “technology empowering nostalgia”.

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