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# Research on the Living Protection and Innovative Pathways of Intangible Cultural Heritage in Guizhou Folk Museums Empowered by Digital Technologies

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**Abstract:** Against the backdrop of China's Digital China initiative and the national strategy of building a culturally strong country, paradigms of intangible cultural heritage (ICH) preservation are shifting from emergency-oriented static documentation toward systematic living transmission. Guizhou, a region characterized by rich multi-ethnic cultural resources, houses numerous folk museums that serve as important carriers of cultural memory. However, conventional object-centered exhibition practices remain insufficient to address the living, processual, and spatiotemporally dynamic nature of ICH. This study examines the application of digital technologies in the protection of ICH within Guizhou folk museums. Through theoretical analysis, technological review, and comparative case studies, it proposes a tripartite living protection mechanism integrating technology, context, and human participation. The paper analyzes Guizhou's structural advantages in policy support, cultural resources, and digital infrastructure, and explicates the internal mechanisms of 3D scanning, virtual reality (VR), and AI-generated content (AIGC) in the deconstruction, reconstruction, and dissemination of ICH. Based on national best practices, it further proposes innovative pathways, including the construction of digital ICH corridors, the development of industry-education integrated curricula, and the alignment with local cultural IPs. Finally, the study addresses challenges such as technological alienation, cultural security, and the digital divide, and suggests evaluation and safeguard mechanisms. This research provides both theoretical insights and practical guidance for the digital transformation of local museums and the enhancement of regional cultural soft power.

**Keywords:** Intangible Cultural Heritage (ICH); digital protection; Guizhou folk museums; living transmission; systematic protection

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## 1. Introduction

### *1.1. Research Background: The Convergence of Digital China and Cultural Strategies*

With the exponential growth of information technologies, digitalization has evolved from a supplementary recording tool into a core driving force reshaping socio-cultural landscapes. The Fifth Plenary Session of the 19th CPC Central Committee explicitly set the long-term goal of building a culturally strong country by 2035. Meanwhile, the 14th Five-Year Plan for Cultural Relics Protection and Technological Innovation further emphasized the urgency of improving museum development quality and activating museum vitality [1].

Within this macro-context, intangible cultural heritage (ICH), as a living carrier of China's excellent traditional culture, has its digital depth and breadth directly linked to the sustainable preservation and creative transformation of national cultural genes. As a culturally rich region with a high degree of ethnic diversity, Guizhou possesses a large number of national- and provincial-level ICH items, encompassing traditional craftsmanship, folk literature, performing arts, and folk customs. However, under the impact of globalization and modernization, many ICH practices that rely on oral transmission and embodied apprenticeship are facing "anemic" challenges, including the aging of inheritors, the shrinking of living spaces, and the fragmentation of audience groups [2]. In particular, local folk museums, serving as front-line institutions for ICH protection and presentation, are confronted with a pressing transition from being mere "repositories of objects" to becoming "interactive cultural fields."

### *1.2. Problem Statement: The Tension between the "Living Nature" of ICH and "Static Exhibitions"*

The core value of ICH lies in its "living nature," whereby skills and meanings are continuously generated and renewed within specific social relations, rituals, and everyday practices. Traditional museum exhibitions, which primarily rely on object display and textual explanations, tend to transform dynamic cultural practices into static objects through decontextualization processes. This weakens public understanding of their social relations, aesthetic logic, and spiritual connotations [1].

The intervention of digital technologies offers new possibilities for resolving this tension. Through technologies such as virtual reality (VR) and augmented reality (AR), museums can reconstruct the generative contexts of ICH within digital environments. Through artificial intelligence (AI), the deep mining of cultural knowledge and personalized narrative construction can be achieved [3]. However, how to avoid the pitfall of technological determinism and realize an organic integration of technology and culture in the concrete practices of Guizhou folk museums remains a critical challenge for both academia and professional practice.

### *1.3. Research Significance and Logical Framework*

The significance of this study is twofold. First, at the academic level, it aims to enrich the theoretical framework of digital ICH protection in local folk museums by exploring new paradigms of "participatory protection" and "systematic protection." Second, at the practical level, it seeks to provide actionable technological solutions and institutional recommendations for Guizhou folk museums, thereby promoting regional cultural digital transformation.

The research follows a logical chain of: background analysis - theoretical support - current condition assessment - technological mechanisms - case comparison - pathway construction - safeguard mechanisms. Through a systematic review of frontier literature and field investigations, the study demonstrates how digital technologies can empower the living transmission of Guizhou's intangible cultural heritage.

## 2. Theoretical Logic and Paradigm Shift in Digital Protection of Intangible Cultural Heritage

### *2.1. The "Second Integration" and the Digital Decoding of Cultural Genes*

The deeper logic of ICH protection lies in adherence to its inherent cultural genes. National discourses on "exploring effective mechanisms for integrating culture and technology" have clearly defined the direction of digitally empowered cultural development [4]. Within the framework of the "second integration"-namely, integrating the basic principles of Marxism with China's excellent traditional culture-the digitalization of ICH is not merely a formal innovation but a modern reconstruction of cultural subjectivity. Through the precise analysis and modeling of core cultural symbols

(such as Miao embroidery patterns and the rhythmic structures of Dong Grand Songs), digital technologies enable the deep extraction and re-expression of cultural genes [5].

*2.2. Systematic Protection from the Perspective of Cultural Ecosystems*

ICH does not exist as isolated techniques but is embedded within specific cultural ecosystems. Contemporary ICH protection is shifting from "emergency-oriented protection" to "systematic protection," emphasizing the interconnections between heritage items and their living environments [5]. Digital technologies can construct comprehensive databases that record not only techniques themselves but also production tools, social organizational forms, and natural environments, thereby enabling holistic preservation of cultural ecosystems in virtual space. This model of holistic protection has already been validated in the development of national-level cultural ecological protection zones [5].

*2.3. The S-O-R Model in Museum Studies and Audience Experience*

In digital exhibition design, the S-O-R (Stimulus-Organism-Response) model provides an important theoretical foundation. Digital experiences, as external stimuli, activate the audiences' emotional organisms-such as empathy, nostalgia, or curiosity-through visual immersion, auditory enveloping, and interactive engagement, ultimately driving responses such as online participation, social sharing, and sustained attention [6]. The activation of this psychological pathway is crucial for folk museums to transition from "science popularization and education" toward "deep cultural identification," as detailed in Table 1.

**Table 1.** Correspondence between Theoretical Dimensions and Guidance for Digital Practice.

| Theoretical dimension | Core principles | Guiding Significance of Digital Practice |
|---|---|---|
| Theory of cultural genes | Core symbols carry collective memory and emotional connection | Guiding digital modeling from "formal similarity" to "spiritual similarity" |
| Systemic protection | Emphasize the integrity of the relationship between ICH and ecological environment | Promote the transformation from single project collection to full-context and all-element digital restoration |
| S-O-R model | Stimuli drive psychological states, thereby eliciting behavioral responses | Optimize interaction design to enhance the empathy and transformation effect of museum digital exhibits |
| Participatory conservation | Establish the core status of the inheritors and coordinate the multiple subjects | Promote platform construction and realize social sharing of digital achievements of ICH |

## 3. Current Landscape and Foundational Conditions of ICH Protection in Guizhou Folk Museums

*3.1. Endowment Characteristics of ICH Resources in Guizhou*

Guizhou is widely regarded as a "window into China's ethnic cultures," with intangible cultural heritage (ICH) resources characterized by comprehensive typologies, multi-level classification, and distinctive regional features. From Miao batik and Bouyei

Bayin seated singing, to the Shui Duan Festival and Yao medicinal bathing practices, these heritage items constitute the most core assets of Guizhou folk museums. However, for a prolonged period, these resources have predominantly been presented through static displays, resulting in relatively low levels of audience interaction [1].

### *3.2. Policy Environment and Institutional Safeguards*

Guizhou Province has demonstrated strong policy commitment to promoting the digitalization of ICH. Since 2022, a series of policy documents-including the Implementation Opinions on Further Strengthening the Protection of Intangible Cultural Heritage-have been issued, establishing cross-departmental coordination mechanisms and providing institutional safeguards for digital ICH initiatives. The specific measures and initial outcomes of this systemic protection structure are detailed in Table 2.

**Table 2.** Structure of Systematic ICH Protection in Guizhou and the Effectiveness of Implementation Measures.

| Systemic protection structure | Specific Measures and Outcomes |
|---|---|
| Top policy design | Establish an interdepartmental joint conference system with 21 departments, and implement the "Interim Measures for Management". |
| Integration and Development Practice | Launch 10 intangible cultural heritage themed tourism routes, including Danzhai Wanda Town and other heritage-themed districts. |
| Cultivation system of talents | Implementation of the 2021-2025 Research and Training Program, with 11 institutions established as training bases. |
| Social incentive mechanism | Carry out the selection of arts and crafts masters to solve the problem of inheritors obtaining professional qualifications through assessment. |

### *3.3. Digital Infrastructure and Preliminary Exploration*

At present, the Guizhou Provincial Museum and several local folk museums have initiated the construction of "cloud exhibition" platforms. Through smart tourism platforms such as One-Code Tour Guizhou, VR panoramic displays have been implemented in selected scenic areas [7]. In June 2025, Guizhou Province organized a training program aimed at enhancing professional capacity in digital ICH documentation, with a particular focus on improving digital recording standards for projects such as Nuo Ritual Skills-Climbing the Sword Ladder [8]. These early-stage technological accumulations and talent development efforts have laid a solid foundation for deeper levels of digital ICH protection.

## 4. Core Application Mechanisms of Digital Technologies in Living ICH Protection

The application of digital technologies in Guizhou folk museums does not constitute an isolated accumulation of tools, but rather forms a living cyclical system encompassing data acquisition, processing, dissemination, and cultural feedback. The full-process pathway of digital ICH protection constructed in this study is illustrated in Figure 1.

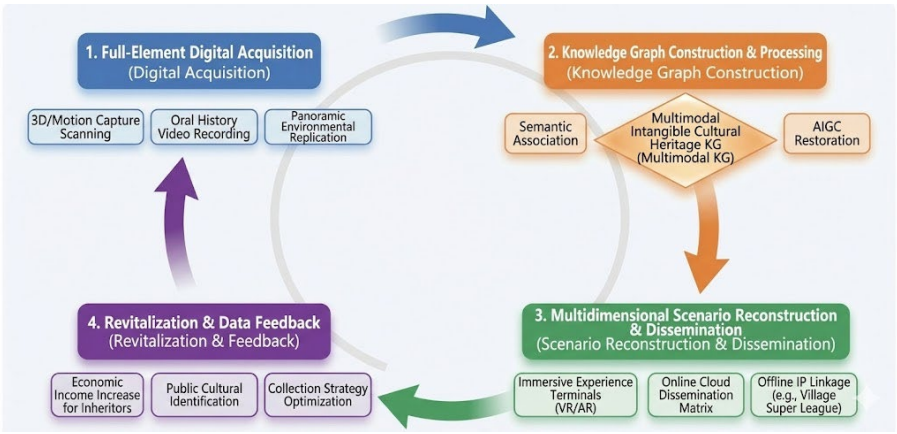


**Figure 1.** Full-process pathway of digital ICH protection in Guizhou folk museums.

*4.1. Digital Preservation and High-Precision Three-Dimensional Reconstruction*

The cornerstone of digital protection lies in high-precision data acquisition. For intricate ethnic crafts in Guizhou-such as silver ornament forging and embroidery patterns-3D scanning and photogrammetry technologies enable the capture of fine textures and structural details [9].

Non-destructive recording of form: High-precision laser scanners are employed to obtain three-dimensional point cloud data of ICH artifacts, providing permanent digital backups for artworks at risk of disappearance due to weathering or damage [9].

Dynamic capture of craftsmanship: Motion capture technologies are used to record the bodily movements and operational gestures of inheritors during performances or craft processes, transforming tacit, embodied knowledge into multi-angle observable digital models and addressing the long-standing challenge of capturing "experiential understanding" in oral transmission [10].

Analysis of color and material properties: Based on photometric stereo techniques and color model analysis (e.g., HSV models), the original colors and textile textures of ethnic costumes can be accurately restored, providing scientific support for subsequent cultural and creative product development [11].

*4.2. Contextual Reconstruction through Virtual Reality (VR) and Augmented Reality (AR)*

The most significant advantage of VR and AR technologies lies in their capacity for de-spatialization and de-temporalization, enabling audiences to enter the original contexts in which ICH practices occur [3].

Immersive situational perception: Within folk museums, visitors wearing VR head-mounted displays can enter virtual scenes of Miao wedding ceremonies or ritual performances. Such deep immersion evokes strong nostalgia and empathetic responses, thereby enhancing cultural identification [1].

Interactive virtual practice: VR-based ICH educational systems allow audiences to experience processes such as silver forging or weaving in virtual environments. This "learning by doing" approach significantly increases the attractiveness and experiential value of ICH [12].

AR-guided hybrid experiences: As visitors move through museum spaces, AR technologies enable mobile devices to overlay historical footage and production processes onto physical exhibits in real time, effectively "giving voice to cultural artifacts" [9].

*4.3. Generative Artificial Intelligence (AIGC) and the Innovative Reproduction of ICH*

The introduction of generative artificial intelligence (AIGC) marks the entry of digital ICH protection into a new stage of content self-generation.

Assisted creative design: Based on input parameters derived from traditional patterns, AIGC systems can automatically generate new patterns or product prototypes aligned with contemporary aesthetic trends. In the revitalization of Guizhou indigo dyeing and weaving traditions, AI enables designers to rapidly explore thousands of pattern combinations [2].

Intelligent storytelling and personalized guidance: AI systems can generate differentiated interpretive narratives in real time according to visitors' age, background, and interests, while also supporting multilingual interaction, thereby greatly enhancing information transmission efficiency [1].

Virtual digital inheritors: AI-driven virtual inheritors capable of 24-hour online interaction address the limitation of human inheritors' physical presence, while stylized or youth-oriented visual representations further attract younger audiences [2]. A summary of the core application logics of these digital technologies in Guizhou folk museums is presented in Table 3.

**Table 3.** Types of Digital Technologies and Their Application Logic in Intangible Cultural Heritage Protection.

| Technology type | Core protection dimension | Application Logic of Guizhou Folk Museum |
|---|---|---|
| 3D Scanning and Printing | Physical evidence | Realizing 1:1 high-fidelity digital restoration and physical replication of complex silver jewelry and architectural components [9] |
| VR/AR/XR | Scene reconstruction and experience | Building a "time-travel" folk custom experience space to solve the monotony of static display [3] |
| AI and AIGC | Intelligent analysis and reproduction | Enhance the retrieval efficiency of massive intangible cultural heritage data to empower innovative design of cultural and creative products [13] |
| Cloud Platform and Blockchain | Shared communication and rights confirmation | Establish a provincial-level intangible cultural heritage cloud platform to protect the digital copyrights of inheritors through blockchain technology |

## 5. Case References: Empirical Insights from National-Level Digital Cultural Initiatives

### *5.1. "Digital Library Cave": From Visibility to Participation*

Through the Digital Library Cave project, the Dunhuang Academy has constructed a trans-temporal, participatory museum environment that transcends physical and temporal constraints (see Figure 2).


**Figure 2.** Promotional video of the Digital Library Cave.

Core strategies: high-precision modeling, gamified narrative structures, and multi-dimensional interaction.

Implications for Guizhou: Guizhou folk museums should break away from the traditional boundary of "do not touch" and enable audiences to participate in the generation of ICH through digital means. For example, in the presentation of bronze drum craftsmanship, museums should move beyond static object display and incorporate audio sampling and virtual percussion experiences, allowing visitors to perceive the powerful integration of sound and imagery.

*5.2. "Digital Central Axis": A Digital Benchmark for Systematic Protection*

Beijing's Digital Central Axis project integrates multi-dimensional data related to urban planning, architecture, and folk culture (see Figure 3).

**Figure 3.** Virtual space of the Beijing Central Axis.

Core strategies: digital twin technology, historical spatiotemporal evolution visualization, and industry-education integrated curricula.

Implications for Guizhou: ICH protection in Guizhou should not be confined to fragmented individual projects, but instead adopt the holistic perspective exemplified by the Digital Central Axis. It is recommended to construct a "Digital ICH Corridor," using temporal, spatial, and ethnic axes as coordinates to interlink the cultural trajectories of Guizhou's diverse ethnic groups [1].

*5.3. "Suzhou Color Lifestyle Pavilion": Aesthetic-Led Technological Integration*

The Suzhou Museum presents Jiangnan aesthetics through digitally mediated exhibition strategies.

Core strategies: Use color as a narrative thread to create exhibition scenarios oriented towards everyday life. For details of the displayed situation, please refer to Figure 4.

**Figure 4.** Visualization space of the 'Suzhou Color Lifestyle' exhibition at Suzhou Museum.

Implications for Guizhou: Digitalization should not be manifested as rigid technological accumulation but should rather prioritize aesthetic communication. Based on the vibrant chromatic systems of ethnic costumes, Guizhou folk museums could curate a "Colorful Guizhou Digital Color Exhibition," enhancing the artistic quality of exhibition spaces through the coordinated use of sound, lighting, and interactive media [1].

## 6. Constructing Innovative Pathways for Digital ICH Protection in Guizhou Folk Museums

*6.1. Building a Closed-loop Mechanism of "ICH + Education + Communication"*

Digitalization should extend beyond exhibition hall upgrades to encompass innovation in social education models.

Establishing an "ICH Digital Application Talent Base": Leveraging local universities such as Guizhou Minzu University, museums and universities should jointly develop training platforms. Students from design and computer science disciplines can be encouraged to participate in virtual ICH modeling, digital picture-book creation, and interactive program development, thereby realizing integrated "production-education-research-application" pathways [1].

Developing "Digital ICH Curriculum Packages" for Basic Education: In response to the aesthetic education needs in primary and secondary schools, animated ICH content and interactive mini-games can be developed and embedded within local teaching and research systems. This early-stage digital education approach lays a broad social foundation for long-term ICH transmission [1].

Operating a Multi-platform Communication Matrix: Shifting away from the passive "waiting-for-visitors" model, museums should utilize livestreaming platforms such as Douyin and Kuaishou to launch "ICH livestream studios," featuring both human inheritors and AI-driven digital avatars. By aligning with high-traffic cultural IPs such as Village Super League and Village Basketball Association, VR spectating combined with ICH experience exhibitions can be introduced during major events, transforming large-scale traffic into cultural identification [1].

*6.2. Promoting the Virtual Extension of "Living Spaces"*

The living nature of ICH requires protection efforts to extend beyond physical exhibition spaces.

Developing a cloud-based "ICH roaming" platform: Using applications such as Qianyun Exhibition, museums should not only display collections but also connect with traditional villages across the province. Audiences can virtually "land" in places such as Xijiang Thousand-household Miao Village or Zhaoxing Dong Village via VR panoramas and experience ICH within its original living environments [14].

Establishing participatory digital documentation mechanisms: Visitors are encouraged to upload visual data during museum visits or folk activities via mobile devices. These crowd-sourced, first-person records will become an important supplement to museum-scale ICH databases, enabling socially collaborative documentation of living heritage [15].

*6.3. Empowering Rural Revitalization and Cultural Creative Industries*

Digital technologies should serve as a bridge for transforming intangible cultural heritage (ICH) into productive forces.

AI-assisted upgrading of ethnic workshops: AIGC technologies can support product design innovation in Miao embroidery and silverwork workshops, enabling the development of derivative products aligned with contemporary lifestyles and aesthetics [2].

Brand-oriented operation of digital ICH: Digital technologies can be used to build internationally recognizable Guizhou ICH IPs. For example, the blockchain-based issuance of ICH-themed digital collectibles (NFTs) can not only diversify museum revenue streams but also attract younger audiences through trend-oriented narratives [3].

## 7. Implementation Safeguards and the Construction of a Scientific Evaluation Framework

*7.1. Establishing a Scientific Digital Evaluation Model*

The achievement of digital projects should not be solely gauged by visual influence; rather, a multi - dimensional assessment system needs to be established [6]. For specific particulars, refer to Table 4.

**Table 4.** Evaluation Dimensions and Indicators for Digital Protection of Intangible Cultural Heritage.

| Evaluation dimensions | Specific indicators | Evaluation Significance |
|---|---|---|
| Content Authority | Historical accuracy and depth of cultural connotation | Ensure digital outcomes remain aligned with cultural core values while maintaining academic rigor [1] |
| Technical performance index | Interaction fluency, rendering quality, and system stability | To ensure a positive user experience for audiences and prevent "negative incentives" caused by technical failures |

| | | |
|---|---|---|
| Audience fit | Stay duration, second visit rate, social media sharing rate | Based on the S-O-R model, evaluate the conversion efficiency of technical stimuli on psychological empathy [6] |
| Output of social education | Related courses covering the number of participants and the mastery rate of knowledge points | Measuring the effectiveness of digital teaching in museums as a "second classroom" |
| Sustainability evaluation | Input-output ratio of capital, frequency of technical platform updates | Ensure digital transformation is not a one-time deal, but rather a long-term evolution capability [16] |

*7.2. Strengthening Cultural Security and Ethical Governance*

While pursuing technological innovation, the risks of "digital alienation" must be carefully addressed.

Preventing excessive commercialization: Strict controls should be imposed on over-entertainment and consumerist tendencies in Intangible Cultural Heritage (ICH) digitalization. When using AI for pattern generation, it is essential to respect minority religious taboos and aesthetic traditions to prevent the proliferation of "pseudo-heritage" [1].

Constructing digital copyright protection systems: The ownership of digitized ICH outcomes is inherently complex. It is recommended to establish distributed ledger-based copyright management platforms that clearly define benefit-sharing mechanisms among museums, inheritors, and technology providers, thereby incentivizing sustained social participation [12].

Bridging the digital divide: For elderly audiences and populations in underdeveloped regions, diversified access terminals should be provided. Museum exhibition spaces should retain necessary tactile and auditory physical interactions to avoid "cultural exclusion" caused by technological barriers [16].

*7.3. Sustained Financial Incentives and Policy Guidance*

Government agencies should position ICH digitalization as a key domain of public cultural services.

Establishing dedicated funding programs: Special funds should be used to support joint research initiatives among universities, museums, and technology enterprises to address common key challenges in ICH digitalization [16].

Building normalized data maintenance mechanisms: Responsibilities for the preservation and updating of digital ICH resources should be clearly assigned across museum hierarchies to prevent data dormancy or digital heritage loss caused by system obsolescence [1].

## 8. Conclusion

The application of digital technologies in the protection of intangible cultural heritage (ICH) within Guizhou's folk museums represents not merely a technological iteration but a fundamental reconstruction of museums' social functions. Through the systematic integration of three-dimensional reconstruction, VR/AR, and AI technologies, ICH can transcend the constraints of physical space and re-enter public life in more vivid and interactive forms. The findings indicate that digitally empowered living transmission effectively evokes nostalgia and cultural empathy, facilitating the intergenerational transmission of cultural genes.

Nevertheless, technology remains a means rather than an end; culture must always remain central. In future digital transformation efforts, Guizhou's folk museums should adhere to a people-centered approach, carefully balancing technological innovation with

cultural authenticity, protection with development, and global discourse with local expression. By constructing a deeply integrated model of "ICH + education + communication," Guizhou's intangible cultural heritage will shine more brightly within the grand blueprint of Digital China, providing robust technological support for safeguarding cultural diversity and strengthening cultural self-confidence.

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