

The Protection of Intellectual Property Rights for the Xinqiao Yanglan Bamboo Weaving Craft in Zhaoqing City Empowered by Artificial Intelligence

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Abstract

Artificial intelligence (AI) technology is bringing about a revolutionary paradigm shift in the safeguarding and transmission of intangible cultural heritage (ICH). While it enhances conservation efficiency and expands transmission pathways, it simultaneously poses structural challenges to the intellectual property (IP) system, which is traditionally based on the protection of individual intellectual creations. This paper takes the Xinqiao Yanglan Bamboo Weaving Craft in Gaoyao District, Zhaoqing City, Guangdong Province, as a specific case study. It delves into the frontier legal dilemmas concerning the definition of rights holders, the assessment of copyrightability, the delineation of fair use boundaries, and the determination of infringement liability for digital ICH outcomes in the context of AI empowerment. The research indicates that the inherent tension between public and private interests becomes more complex with AI's involvement. Consequently, this paper proposes clarifying the ownership rules for AI-generated content through legislation or judicial interpretation, constructing a special statutory licensing system tailored for the digital utilization of ICH, enhancing the flexibility of fair use doctrines to accommodate technological advancements, and comprehensively utilizing technologies like blockchain to build a credible system for rights confirmation, utilization, and protection. The aim is to construct an IP legal framework that effectively incentivizes innovation, safeguards the legitimate rights and interests of all parties, and promotes the widespread dissemination and sustainable development of ICH knowledge, providing theoretical support and pathway guidance for the living inheritance of ICH in the digital age.

Keywords

Artificial Intelligence; Intangible Cultural Heritage; Intellectual Property Protection; Yanglan Bamboo Weaving; Digital Transmission.

1. Introduction

Intangible Cultural Heritage (ICH), defined as the "various traditional cultural expressions inherited from generation to generation by all ethnic groups and regarded as part of their cultural heritage,"[1] represents the essence and living gene of national culture. Its protection and transmission are crucial for preserving cultural diversity and enhancing national cultural soft power. In the digital age, technological advancements present unprecedented opportunities for ICH safeguarding. The Opinions on Promoting the Implementation of the National Cultural Digitalization Strategy issued by the General Office of the CPC Central Committee and the General Office of the State Council explicitly call for deeper integration of culture and technology. Within this context, the 14th Five-Year Plan for Intangible Cultural Heritage Protection specifically emphasizes the need to "comprehensively utilize digital

technology means such as images, audio, and video to conduct in-depth digital processing of ICH resources." [2]Artificial Intelligence (AI), as the core engine of the digital wave, is profoundly reshaping the paradigms of ICH protection, research, transmission, and dissemination through its powerful capabilities in data processing, pattern recognition, and content generation, facilitating a transition from traditional "salvage recording" to "preventive conservation" and "innovative development." [3]

However, technological empowerment often accompanies institutional tension. Intangible cultural heritage is, by nature, a public cultural resource collectively created and evolved over time, whose core value lies in sharing and transmission. In contrast, the modern IP system, particularly copyright law, is fundamentally based on protecting creators' exclusive rights to "original" intellectual creations, characterized by a distinct "private interest" attribute. The intervention of AI technology, while enhancing the effectiveness of ICH protection, significantly intensifies the inherent tension between the "public nature" of ICH and the "private interest" emphasis of the IP system. [4]This tension manifests in concrete questions: Who is the rights holder of AI-generated content? How is the originality of outcomes resulting from the digital replication or innovative adaptation of ICH determined? Under the public interest goal of promoting cultural dissemination, how are the legal boundaries of AI-driven new uses, such as data mining and virtual experiences, defined?

The Xinqiao Yanglan Bamboo Weaving Craft in Gaoyao District, Zhaoqing City, serves as a representative example of a distinctive handicraft ICH project in the Lingnan region. It carries profound local culture and ethnic wisdom but also faces common challenges such as the aging of practitioners, limited dissemination scope, and insufficient innovative transformation. [5]Applying AI technology to the protection and development of this craft-for instance, by establishing digital archives through 3D scanning, innovating patterns using generative AI, and creating immersive experiences via VR/AR technologies-is undoubtedly a vital pathway for achieving its "creative transformation and innovative development." [6] Yet, this process also makes it an ideal case study for observing and analyzing the aforementioned IP dilemmas. If these legal challenges are not effectively resolved, they risk dampening the enthusiasm of both practitioners and technology developers, hindering the healthy development of the digital ICH industry, and potentially leading to the "de-contextualization" and "alienation" of ICH during digitalization.

Therefore, this paper, grounded at the forefront of AI technology development and using the Xinqiao Yanglan Bamboo Weaving Craft as a specific case, aims to systematically review and deeply explore the core IP controversies exposed in the process of AI-empowered ICH transmission. By drawing on relevant domestic and international theories and practices, it attempts to propose a set of legal improvement solutions that align with both IP jurisprudence and the particularities of ICH safeguarding. The goal is to provide academic reference for building a balanced, open, and sustainable ICH IP governance system in the digital age and to offer legal guidance for the future development of specific ICH projects like the Yanglan Bamboo Weaving Craft.

2. The Dual Aspects of AI Empowerment in ICH IP Protection: Reshaping Opportunities and Escalating Challenges

The application of AI in the ICH field is not merely a simple instrumental addition but represents a profound revolution in the conservation paradigm. It brings about a qualitative leap in protection efficacy while also triggering systemic challenges at the level of IP rules.

2.1. Technological Empowerment: A Paradigm Shift from "Static Archiving" to "Intelligent Vitalization"

AI technology is driving the work of ICH protection from a traditional, relatively passive "static archiving" model towards a dynamic, interactive, and forward-looking model of "intelligent vitalization." This transformation is evident at several levels:

High-Fidelity Digital Capture and Structured Archiving: For ICH items like Yanglan bamboo weaving, which involve complex processes and high detail, AI-driven technological methods achieve unprecedented recording accuracy. Through "3D scanning and laser mapping technology," high-precision geometric information and texture data of finished bamboo woven products can be obtained non-destructively, generating measurable and analyzable digital models. Combined with "multimodal data collection technology" (e.g., HD video, surround audio, force sensors), the entire process from material selection and splitting to weaving and finishing can be systematically recorded, even capturing subtle hand movements and pressure changes. This multi-dimensional, structured data collection forms a solid foundation for digital ICH archives, providing a scientific basis for subsequent restoration research and authenticity identification.

Knowledge Graph Construction and Semantic Organization: Moving beyond simple database storage, AI enables deep knowledge mining and correlation of ICH resources. Using Natural Language Processing (NLP) technology, unstructured texts related to Yanglan bamboo weaving-such as historical documents, local chronicles, and oral history interview recordings-can be processed for entity recognition, relationship extraction, and sentiment analysis. This automatically constructs a "knowledge graph" covering material properties, tool evolution, core techniques (e.g., "lift one, press one," "braiding"), pattern symbolism, lineage transmission, and even regional stylistic evolution. This systematizes and makes explicit knowledge that was previously scattered and implicit, forming a "cultural semantic web" understandable and inferable by machines, significantly improving the efficiency and depth of ICH research.

Immersive Experiences and Generative Innovation: AI vastly expands the dimensions of ICH display and dissemination. Virtual Reality (VR) and Augmented Reality (AR) technologies can reconstruct a "virtual bamboo weaving workshop" based on digital models, allowing users to immerse themselves in the weaving environment and process. Generative Artificial Intelligence (e.g., GANs, Diffusion models), after learning from vast datasets of bamboo weaving patterns, can generate design patterns that retain traditional essence while incorporating novel concepts. This provides practitioners and designers with rich creative inspiration and proposal references, facilitating the leap from "skill transmission" to "design innovation." This not only promotes the deep integration of ICH with cultural, creative, and tourism industries but also allows its cultural connotations to be disseminated in more modern and publicly accessible ways, truly realizing the shift from "passive protection" to "active vitalization."

2.2. Legal Challenges: Redefining the Boundaries of the Intellectual Property System

The rapid advance of technology increasingly highlights the lag of existing IP systems, giving rise to a series of urgent legal issues in the ICH domain.

Proliferation of Rights Holders and Attribution Dilemmas: The creation and transmission of ICH are characterized by collectivity and historicity, making rights holders inherently difficult to define clearly. The introduction of AI brings new stakeholders-algorithm designers, data engineers, platform operators-rendering the issue of rights attribution extremely complex. For example, who should hold the copyright for a new bamboo woven lampshade design generated by an AI system trained on data from the Yanglan Bamboo Weaving Craft? Is it the practitioner who provided the core technical data and guidance? The tech company that invested significant resources in algorithm R&D and model training? Or the cultural administration department

responsible for project organization and coordination? This "unclear ownership relationship can intensify rights disputes during the digitalization of ICH," severely hindering social capital investment and subsequent commercial development, as potential users cannot ascertain from whom to obtain permission.

Blurring Standards for Assessing Originality of the Protected Subject Matter: The core of copyright law protection is "original" expression. However, in the AI context, determining "originality" becomes exceptionally challenging. Firstly, for "replicative digitalization" outcomes, such as digital models of Yanglan bamboo woven objects generated via high-precision 3D scanning, the goal is "faithful reproduction" of the original, not the expression of individual creativity. Therefore, they are likely to be excluded from copyright protection due to a lack of that "creative spark." Secondly, for "creative digitalization" outcomes, such as "new" patterns generated by AI after learning from numerous traditional motifs, is the "originality" derived from the "autonomous" decisions of the AI algorithm, the instructional design of the human programmers behind it, or the traditional patterns constituting the training data itself? This qualitative ambiguity directly leads to judicial uncertainty.

Inadequacy of Fair Use Doctrine in Addressing New Behaviors: The fair use doctrine is a key safety valve balancing the interests of rights holders with the broader public interest. However, China's current "rule-based" legislative model, which stipulates specific fair use scenarios in a closed list, struggles to encompass new use behaviors catalyzed by AI technology. For instance, does a university research institute's use of AI to conduct Text and Data Mining (TDM) on a large number of bamboo weaving digital images and literature for analyzing the craft's evolution constitute fair use? Where are the boundaries when a public library uses AI technology to generate smart tags and audio descriptions for Yanglan bamboo weaving digital resources to enhance public access and experience? Such behaviors lack clear authorization under the current legal framework, causing public cultural institutions to be "somewhat restricted in their flexibility and innovation capacity during modern transformation" when launching innovative services, acting cautiously, which is detrimental to the widespread dissemination and educational function of ICH.

3. Current Status of IP Protection for the Xinqiao Yanglan Bamboo Weaving Craft and Focused Dilemmas under AI Empowerment

The Xinqiao Yanglan Bamboo Weaving Craft has a long history and unique techniques, representing a valuable cultural asset of the Zhaoqing region. However, its current state of IP protection is concerning. The application of AI technology, while promising, makes the legal issues it faces more specific and acute.

Marginalization of Practitioners and Imbalanced Benefit-Sharing under AI Application: Similar to many traditional handicraft ICH items, Yanglan bamboo weaving faces challenges of "aging practitioners and a broken transmission lineage." Younger generations show little interest in learning, and skill transmission relies mainly on a few elderly individuals. In AI digitalization projects, practitioners, as the sole living repository of technical knowledge, are the most core and irreplaceable data source for AI model training. However, in current practice, practitioners often find themselves at the bottom of the value chain. They might receive a one-time labor payment but cannot participate in sharing the long-term benefits generated from the repeated use of their technical data by AI and its development into various derivatives. This inequity in benefit distribution stems from a "disconnect between public and private rights," lacking clear legal rules to confirm and protect the fundamental property and moral rights of practitioners within the digital industry chain. Failure to establish a fair "benefit-sharing mechanism" will severely dampen practitioners' enthusiasm and potentially accelerate the loss of the craft.

Uncertainty over Copyright Ownership of Digital Outcomes Hinders Innovative Transformation: The digital outcomes of Yanglan bamboo weaving are diverse, and their legal qualification varies accordingly. Simple recording videos might constitute video recordings (a related right), while well-edited, scored, and narrated documentaries might constitute audiovisual works. However, the legal status of AI-generated designs, virtual scenes, etc., remains ambiguous. This uncertainty becomes a "stumbling block" for industrialization. Cultural and creative enterprises wishing to use AI-generated bamboo weaving patterns for product design face high legal risks due to the inability to clearly establish rights, causing them to hesitate. This directly restricts the process of "deeply integrating intangible cultural heritage with tourism" and developing characteristic cultural industries, hindering the craft's ability to become self-sustaining.

Limited Scope for Fair Use Affects the Effectiveness of Public Cultural Services: Public institutions like cultural centers and museums in Zhaoqing City and Gaoyao District are the main platforms for displaying, educating about, and disseminating the Yanglan Bamboo Weaving Craft. They are eager to use AI technology to enhance services, such as establishing a "digital collection database platform" [7] or developing AI-assisted educational courses or interactive exhibitions. However, due to the narrow scope of the current fair use system, when these institutions engage in data analysis and content development that goes beyond the narrow purpose of "exhibition or preservation," they risk infringement. This legal risk makes public cultural institutions conservative in their digital innovation, limiting the maximization of social benefits from ICH resources, which runs counter to the public goal of "promoting the widespread circulation of digital outcomes and fully exploring the cultural connotations of ICH."

4. Perfecting the Legal Pathway for IP Protection of the Yanglan Bamboo Weaving Craft in the Context of AI Empowerment

Faced with the challenges outlined above, it is necessary to make targeted adjustments and improvements to the existing IP legal system, constructing a governance framework that both incentivizes innovation and safeguards the public interest.

4.1. Clarifying Rights Ownership and Constructing a Fair and Reasonable Benefit-Sharing Mechanism

Establishing the Central Role of Practitioners in Digital Legal Relationships: Laws or policies should clarify that practitioners hold initial rights to the technical knowledge and data that form the basis for AI training. In any AI digitalization project, standard contracts or mandatory provisions should ensure practitioners' rights of attribution and remuneration. Remuneration calculations should not be limited to labor during data collection but should establish a long-term benefit-sharing mechanism linked to the benefits of subsequent commercial use, such as a royalty model. This respects the "living" nature of ICH and is a requirement for achieving fairness and justice.

Clarifying Copyright Ownership Rules for AI-Generated Content: It is recommended to amend the Copyright Law or for the Supreme People's Court to issue judicial interpretations that distinguish the ownership of AI-generated content:

Human-Led Creation: For content where a natural person (e.g., designer, programmer), based on their own creativity, substantially uses AI as a tool and exerts essential intellectual contribution to the final outcome, copyright should belong to that natural person. AI is considered an advanced "paintbrush" or "musical instrument" here.

AI-Led Generation: For content with a high degree of automated generation and minimal human creative input, consideration could be given to creating a sui generis related right, vesting it in the entity that made substantial investment in data preparation, algorithm training,

and system operation (e.g., the project undertaking unit or tech company). The content of this right could focus on the economic right to remuneration, stipulating that its exercise must appropriately indicate the data source (e.g., "This design is inspired by the Xinqiao Yanglan Bamboo Weaving Craft"), respecting practitioners' right of attribution and moral rights. Simultaneously, a protection term shorter than regular copyright could be set for such content. Promoting the Application of Extended Collective Licensing in the ICH Field: Learning from the experience of Nordic countries, explore establishing Extended Collective Licensing for specific types of ICH (e.g., traditional crafts). Even if some practitioners are not members of the collective management organization, the license agreement concluded by the organization with a user could extend to the works (digital outcomes) of these non-member practitioners, but the usage fees must be distributed to non-members according to certain rules. This effectively solves the problem of mass licensing, reduces transaction costs, and is particularly suitable for cases like Yanglan bamboo weaving that may involve numerous potential practitioners and usage scenarios.

4.2. Perfecting Rights Limitation Systems to Reserve Ample Space for Public Interest and Innovation

Introducing an Open Factor Test to Enhance Fair Use Flexibility: While retaining the existing list of specific circumstances, an open-ended provision should be added to the Copyright Law, allowing courts to refer to the internationally accepted "four-factor test" (purpose and character of the use, nature of the copyrighted work, amount and substantiality of the portion used, effect upon the potential market) for comprehensive analysis when adjudicating new types of cases. Particular weight should be given to "transformative use" in determining fair use. For example, using AI for Text and Data Mining (TDM) of Yanglan bamboo weaving digital resources for academic research, aiming to generate new scholarly insights rather than merely replicate the original work, and without affecting the normal market for the work, should lean towards being considered fair use.

Constructing a Special Statutory Licensing System for Digital ICH Resources: For already published digital ICH resources, where the rights holder cannot be found or does not respond, users could apply to the national copyright authority (e.g., National Copyright Administration) for special statutory licensing. Upon review and approval, and after paying usage fees according to standards set by the authority or market rates into a designated account (e.g., a collective management organization), the use would be legal. These fees would subsequently be distributed to the rights holders. This ensures the usability of ICH resources while safeguarding the remuneration rights of rights holders, achieving a balance between public and private interests.

4.3. Strengthening Technological Empowerment and Collaborative Governance to Build a Comprehensive Protection System

Utilizing Blockchain Technology to Build a Credible Chain of Rights Confirmation and Traceability: Encourage the establishment of a blockchain-based copyright registration and transaction platform for Yanglan bamboo weaving digital resources. Practitioners and creators can store hashes, metadata, and ownership information of digital outcomes on the chain, generating legally effective electronic evidence. Every authorization, transfer, license, and even end consumption can be recorded on the chain, forming an immutable full-lifecycle traceability map, providing strong technical support for infringement determination and rights protection. **Establishing a Sound Multi-Stakeholder Co-governance Mechanism:** Promote the formation of a collaborative governance pattern guided by the government, with practitioners as the main body, with societal participation, and supported by technology. Cultural administrative departments should take the lead in formulating standards, specifications, and data ethics

guidelines related to ICH digitalization. Encouraging "the establishment of internal copyright management departments in large public cultural institutions" responsible for managing the copyrights of their ICH digital assets, compliance review, and authorized operations. Simultaneously, strengthen inter-departmental coordination; culture, copyright, industry and information technology departments should form synergies to jointly promote the implementation of ICH IP protection policies.

5. Conclusion

The rapid development of artificial intelligence technology has injected powerful technological momentum into the protection and transmission of intangible cultural heritage like the Xinqiao Yanglan Bamboo Weaving Craft in Zhaoqing, opening up unprecedented possibilities. However, it has also pushed the traditional intellectual property system to a crossroads requiring profound reform. The analysis in this paper reveals that the core legal dilemmas in AI-empowered ICH protection stem from the increasingly pronounced tension between its collective, living public cultural nature and the IP system's emphasis on individual originality and private rights protection, concretely manifested in key areas such as rights attribution, originality determination, and fair use.

Addressing these challenges cannot be achieved by simply applying existing rules; it requires a synergy of conceptual and institutional innovation. We must adhere to the basic principles of "balanced governance" and "innovation-friendliness." On the one hand, clear rules on rights attribution and fair benefit-sharing mechanisms are needed to fully protect the legitimate rights and interests of core stakeholders like practitioners and creators, stimulating their endogenous motivation to participate in digital transmission and innovation. On the other hand, introducing flexible fair use rules and constructing special statutory licensing systems are necessary to reserve sufficient legal space for public interest uses, academic research, and innovative transformation, ensuring that ICH, as a common wealth of society, can be widely disseminated and sustainably utilized.

Ultimately, our goal is to build a digital-era ICH intellectual property ecosystem framed by legal norms, supported by technical standards, and based on multi-stakeholder governance. This system should be dynamic, open, and inclusive, capable of effectively resisting infringement while actively promoting cultural prosperity. Only in this way can precious heritage like the Xinqiao Yanglan Bamboo Weaving, which embodies generations of craftsmanship and local context, not only survive but also radiate new brilliance in the age of AI, laying a solid rule-of-law foundation for achieving the strategic goal of becoming a leading cultural nation. Future research could focus on deeper issues such as specific standards for identifying AI-generated content and ICH protection in cross-border data flows.

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