

# Innovative Pathways and Practical Research on the Living Heritage Transmission of Jingdezhen Ceramic Intangible Cultural Heritage (ICH) in the Digital-Intelligent Era

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**Abstract:** Against the backdrop of the Digital-Intelligent Era, the digital wave not only reshapes the inherent cultural connotations of Jingdezhen ceramic Intangible Cultural Heritage (ICH) as a "living cultural memory" but also endows it with the potential for the development of regenerative cultural resources. The transmission of ICH thus faces unprecedented opportunities and challenges. Jingdezhen ceramic ICH is undergoing a paradigm shift from "static preservation" to "living heritage transmission." As the core carrier of Chinese ceramic culture, Jingdezhen has become the focus of attention for the living transmission of its ceramic ICH techniques in today's interactive and diversified digital communication environment. By analyzing the artistic transformation and cultural reconstruction mechanisms of Jingdezhen ceramic ICH in the digital context, this study proposes an innovative practical paradigm for living heritage transmission, explores its construction logic and contemporary value, and verifies the promotional effects of pathways such as digital exhibitions, virtual immersive experiences, digital collectibles, and new media/live streaming platforms on the living transmission of ICH through empirical research. This research aims to provide methodological references for the digital transmission of ICH and promote the creative transformation and innovative development of the living transmission of Jingdezhen ceramic ICH techniques.

**Keywords:** Digital-Intelligent Era; Jingdezhen Ceramics; Intangible Cultural Heritage (ICH) Techniques; Living Heritage Transmission; Digitalization; Pathways; Innovation.

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## 1. Introduction

In the Digital-Intelligent Era, driven by the rapid iterative upgrading of digital information technology and the in-depth evolution of the information age, profound transformations have taken place in the subjects, channels, and audiences of ICH communication. Notably, the communication subjects have expanded, followed by the diversification and digitalization of communication channels. Diversification is mainly reflected in the use of new channels such as new media, short videos, and live streaming for ICH dissemination. Meanwhile, the emergence of digital-intelligent technologies like Virtual Reality (VR) and Augmented Reality (AR) has greatly enriched the display and communication methods of ICH techniques. To sustain the vitality of ICH and achieve the ultimate goal of natural transmission, the inheritance of ICH requires not only the protection of traditional techniques but also the expansion of communication channels. [1-2]

As an integral part of China's excellent traditional culture, Jingdezhen's ICH should not only be subject to rescue protection but also actively implement the initiative of "creative transformation and innovative development" proposed by General Secretary Xi Jinping. It is essential to keep pace with the times in updating the digital communication forms of Jingdezhen's "ICH" art, reinterpret and annotate it using digital technology and modern discourse systems, endow Jingdezhen ceramic ICH techniques with new connotations of the era, and conduct innovative designs to connect it with modern life, thereby fostering sustainable development.

Jingdezhen's porcelain-making history dates back to the Five Dynasties, with its techniques gradually maturing during

the Song and Yuan Dynasties. In the Ming and Qing Dynasties, it evolved into the national porcelain-making center and developed a sophisticated division of labor system known as "seventy-two processes to complete a piece of porcelain." Jingdezhen ceramics, renowned for their unique charm of "white as jade, bright as a mirror, thin as paper, and resonant as a chime," embody the millennium-old craft wisdom and aesthetic tastes of Chinese civilization. In 2006, Jingdezhen's handmade porcelain-making techniques were included in the first batch of the National Intangible Cultural Heritage List, serving as an outstanding representative of national ICH. Its core value is reflected not only in the artistic height of the finished products but also in a series of complex and exquisite manual processes, from raw material selection and clay kneading/shaping to glazing and firing.

However, with the acceleration of industrialization and globalization, the traditional inheritance model based primarily on oral instruction and hands-on mentoring is facing severe challenges, such as the aging of senior craftsmen, the shrinking of young inheritor groups, and the imminent loss of some core techniques. Against this backdrop, the rise of digital technology has opened up new possibilities for the protection and inheritance of ICH. The application of cutting-edge technologies such as 3D scanning, motion capture, virtual reality, and big data in the field of ceramic ICH not only enables more accurate, systematic, and permanent recording but also significantly expands its communication boundaries and experiential dimensions, attracting the attention and participation of more young people. Therefore, how to scientifically and effectively utilize digital means to promote Jingdezhen ceramic ICH from "static preservation" to "living heritage transmission" has become an important issue of common concern in both academic and industrial

circles.

## 2. The Advent of the Digital-Intelligent Era and the Transformation of the ICH Inheritance Paradigm

With the rapid development of new-generation information technologies such as artificial intelligence, big data, and cloud computing, human society has fully entered the "Digital-Intelligent Era." The characteristics of this era lie not only in technological iteration but also in the in-depth involvement and reconstruction of cultural ecology by technology. For Jingdezhen ceramic ICH, a treasure of Chinese civilization, the digital-intelligent wave is both a challenge and a rare historical opportunity.

The traditional ICH protection model often focuses on "rescue recording" and "museum-style display." While this static protection method preserves the physical form of the techniques, it struggles to replicate their generative context and cultural vitality. As Song Zhen, Deputy Curator of the Ningbo Intangible Cultural Heritage Protection Center in Zhejiang Province, pointed out, the core of ICH lies in the symbiosis of "people" and "techniques," as well as the cultural memory embedded in the evolution of techniques. How to make ICH "thrive in the present" and "transmit to the future" is an important proposition entrusted by the Digital-Intelligent Era. Therefore, against the backdrop of the Digital-Intelligent Era, Jingdezhen ceramic ICH techniques are in urgent need of completing the paradigm shift from "static persistence" to "living heritage transmission." [3-5]

The so-called "living heritage transmission" refers to integrating ICH into the current life context and communication field using modern scientific and technological means while maintaining its core techniques and cultural connotations, thereby endowing it with new vitality through interaction with modern society. Digital-intelligent technology provides the underlying logical support for this transformation: through high-precision digital acquisition, the fingertip pressure in ceramic shaping and the temperature control curve of kiln firing can be converted into storable and analyzable data assets; through VR and AR technologies, ancient porcelain-making scenes can transcend the constraints of time and space to achieve immersive reproduction. This paradigm shift involves not only the digital archiving of the techniques themselves but also the digital reconstruction of the ceramic cultural ecology. It externalizes the tacit and implicit craftsman knowledge, opening up new dimensions for the living transmission and educational popularization of ICH techniques.

## 3. Practical Dilemmas in the Inheritance of Jingdezhen Ceramic ICH Techniques

The inheritance of Jingdezhen ceramic ICH techniques is a dynamic and complex social-cultural process. Currently, its traditional ecology is being impacted by multiple factors, with the main dilemmas reflected in the following aspects:

### 3.1. Risk of Disruption in Core Technique Inheritance

Jingdezhen's traditional porcelain-making techniques, especially key links such as manual shaping, glaze preparation, and wood-fired kiln operation, are highly

dependent on the long-term practical experience of inheritors and the ineffable "embodied" knowledge. This form of transmission through oral instruction and hands-on mentoring relies on long-term learning and repeated practice between masters and apprentices. However, under the impact of the fast-paced lifestyle and diversified career choices in modern society, fewer young people are willing to invest the long time and cost to learn traditional crafts. At the same time, senior inheritors who master core techniques are passing away one after another, leading to a direct risk of loss of some unique processes and key know-how, and the potential breakdown of the technique inheritance chain.

### 3.2. Loss and Misinterpretation of Cultural Connotations

A fine piece of Jingdezhen ceramics is not only a product of exquisite craftsmanship but also a material carrier of social culture, aesthetic philosophy, and lifestyle in a specific historical period. Its shape, patterns (e.g., interlocking lotus patterns, a traditional Chinese decorative pattern symbolizing prosperity), and glaze colors all contain rich cultural codes. In the wave of marketization, some productions prioritize efficiency and commercial interests, leading to product homogenization and symbolization. The cultural connotations behind traditional artifacts are insufficiently explored and even misinterpreted. The public's cognition of Jingdezhen ceramics may remain at the superficial level of "exquisite commodities," ignoring their profound historical and cultural value as ICH, which results in the dilution and loss of the cultural context of Jingdezhen ceramic ICH.

### 3.3. Limitations of Communication and Experience Methods

Traditional ICH communication methods mainly rely on static museum displays, offline workshop experiences, and book/journal introductions. Although these methods are authoritative and intuitive, they have inherent limitations in terms of communication scope, interactivity, and experience depth. Geographical constraints make it difficult for the general public to visit Jingdezhen in person to experience the porcelain-making atmosphere, and static exhibits cannot fully reproduce the complex dynamic production processes. This limited communication and experience model restricts the establishment of public awareness and emotional connection with ceramic culture to a certain extent.

## 4. Internal Mechanisms and Reconstruction Logic of the Digital Transformation of Jingdezhen Ceramic ICH Techniques

### 4.1. Data Deconstruction and Explicit Expression of Embodied Techniques

Jingdezhen ceramic ICH techniques represent a typical form of embodied knowledge, whose inheritance has long relied on the master-apprentice system of "oral instruction and heart-to-heart transmission." The feel during clay kneading, the touch of the knife during trimming, and the brushwork during painting are often intuitive yet ineffable. This experience accumulated through long-term oral communication, demonstration, and practice is intangible, complex, and systematic, facing not only the crisis of "no successors" in technique inheritance but also the dilemma of

marginalization in cultural communication.

In the Digital-Intelligent Era, the inheritance of Jingdezhen ceramic ICH requires not only the protection of traditional techniques but also the expansion of inheritance channels. Digital technology and modern discourse systems enable the reinterpretation of these techniques, while motion capture systems, force feedback devices, and 3D scanning technologies convert these subtle embodied experiences into precise digital models. For example, high-precision sensors can be used to record the pressure distribution and movement trajectories of the hands of national ICH inheritors during clay shaping, constructing a "Master Technique Database." This is not only an accurate record of the techniques but also a "demystification" deconstruction process, transforming vague experiences into visual data streams and laying the foundation for subsequent algorithmic analysis and simulation teaching. This transformation does not diminish the spirit of craftsmanship but rather externalizes tacit knowledge through technical means, thereby expanding the breadth and depth of technique inheritance. [6-8]

#### **4.2. Digital Storage and Spatiotemporal Reconstruction of Cultural Memory**

Ceramic ICH is not only a set of techniques but also a cultural memory embedded in specific historical time and space. Traditional textual and visual records struggle to restore the overall cultural context of ceramic production. Through the construction of a "digital twin" system, digital technology can not only fully replicate the historical relics of Jingdezhen's handmade porcelain industry, such as the Hutian Ancient Porcelain Kiln Site and the Gaoling Kaolin Mine Site but also, more importantly, enable the connection and reorganization of fragmented information scattered in different documents, museums, and inheritors' oral accounts through digital-intelligent technology, constructing a multi-dimensional cultural knowledge map of ceramic ICH.

In this virtual digital-intelligent space, users can not only view exquisite porcelain from multiple angles but also "travel back" to Jingdezhen during the Ming and Qing Dynasties, experiencing the grand scene of "craftsmen gathering from all corners of the world and products being transported to every corner of the globe." This spatiotemporal reconstruction breaks the limitations of linear historical narratives, endowing ICH with non-linear, interactive, and immersive narrative capabilities, and greatly enhancing the appeal and penetration of cultural memory.

#### **4.3. Immersive Interaction and Emotional Resonance in Aesthetic Experience**

In traditional museum exhibitions, exhibits are placed in glass cabinets with fixed viewing distances and angles, and the aesthetic experience they bring to the audience is passive and visually dominant. In contrast, living heritage transmission in the Digital-Intelligent Era emphasizes multi-sensory immersive experiences. Through Mixed Reality (MR) technology, visitors can personally experience the entire process of clay shaping, glazing, and kiln firing in the virtual space set up in the exhibition hall, and even feel the damping of the soil and the temperature of the flame through haptic feedback devices.

This embodied interactive experience breaks the original boundary between "viewing" and "operating," transforming the audience from bystanders into participants, thereby generating emotional resonance with the craftsmanship spirit

of Jingdezhen ceramic ICH during in-depth interaction. This emotional connection is the core of living heritage transmission. It makes the ancient Jingdezhen ceramic ICH techniques no longer a distant past but a tangible present experience, thereby stimulating the younger generation's sense of identity and belonging to traditional culture.

### **5. Innovative Pathways and Practical Research on the Living Heritage Transmission of Jingdezhen Ceramic ICH Techniques**

#### **5.1. Constructing a Two-Dimensional Digital Resource Library**

To address practical dilemmas such as the concentration of technique masters in middle-aged and elderly groups, insufficient participation of the younger generation, and difficulties in transmitting tacit knowledge, digital protection has become a fundamental pathway for the living heritage transmission of handmade porcelain techniques. Supported by digital technology, it is possible to break the information fragmentation of traditional recording methods and achieve the comprehensive preservation of technical operations, artifact forms, and cultural contexts.

3D laser scanning technology can conduct high-precision modeling of ancient ceramic artifacts, traditional kilns, and porcelain-making tools, accurately restoring their morphological details and structural characteristics, and providing standardized digital archive resources for subsequent research and teaching; motion capture and biosensor technologies can real-time record hand movements, posture changes, and force parameters in key processes such as clay shaping and trimming, converting the ineffable tacit experience into a quantifiable and traceable knowledge system; on this basis, combined with eye-tracking technology and in-depth interviews, it is possible to further capture the empirical logic of inheritors in judging kiln temperature and preparing glazes, ensuring the systematic and complete digital preservation of tacit knowledge.

The continuous iterative upgrading of digital-intelligent technology has attracted an increasing number of outstanding innovative technology teams to create diversified typical cultural scenarios, jointly exploring the innovative paradigm of digital technology to promote the revitalization of Chinese culture. For example, the "Context China" ICH Digital Living Heritage Transmission Project was officially launched in Jingdezhen in May 2025. Relying on an all-media matrix and digital technology, the project establishes an ICH database, collects and stores ICH information through interviews with inheritors, experts, and scholars, and conducts new media live streaming operations and immersive exhibitions. It has built a multi-dimensional digital archive system for ICH inheritance, witnessed the in-depth dialogue between traditional ICH and the digital age, and opened a new chapter in ICH transmission. The implementation of the project not only enriches ICH information resources but also provides important data support for subsequent digital communication and activation practices. [9-11]

Another example is the "Tanyuan Plan 2024" Ceramic Digital Optical Twin Solution Project based on time-domain technology, officially launched in March 2025. Through the innovative funding and incubation of "culture + science and technology" and multi-path, all-round support, Jingdezhen

has successfully constructed digital assets for more than 10,000 ceramic artifacts relying on time-domain technology-based ceramic digital optical twin technology and big data technology, and institutionalized core feature data such as decorative patterns and body glazes through an "ancient ceramic gene bank." In addition, the "One Porcelain, One Chain" system built using blockchain technology has established "digital craftsman records" for hundreds of inheritors and provided traceability certification for more than 100,000 high-end artistic porcelain products, realizing the dual recording and protection of process data and cultural identity. The "technique + culture" two-dimensional digital resource library constructed on this basis should include three sub-libraries: the Core Technique Library, which records standardized process flows and operational parameters; the Artifact Resource Library, which covers digital models and cultural annotations of ancient ceramics and modern excellent works; and the Craftsman Knowledge Library, which integrates interview records, experience insights, and oral historical materials. The intelligent management platform built using AI and big data technology can realize intelligent resource retrieval, dynamic updates, and differentiated access, providing accurate services for different roles.

## **5.2. Building a Cross-Media Digital Narrative System in Digital Communication**

In response to the insufficient coverage of traditional communication channels for Jingdezhen ceramic ICH techniques and the limited reach to cross-regional and young groups, digital communication pathways can enhance communication efficiency and cultural influence through multi-level and multi-channel approaches. Based on cross-media narrative theory, a digital communication system centered on immersive experience, interactive communication, and content innovation can be constructed. VR and AR technologies are the core support for realizing immersive communication. By building virtual ceramic workshops, the entire process of traditional porcelain making can be accurately reproduced, allowing users to personally experience the operational details of key processes such as clay shaping, glazing, and kiln firing through immersive interaction; implanting AR navigation systems in offline scenes such as museums and ancient kiln sites can realize the superposition of digital information and physical scenes. Tourists can obtain in-depth content such as process demonstrations and historical explanations in real time through mobile terminals, significantly improving the richness and interest of the Jingdezhen ceramic ICH technique experience.

In addition, in line with the information reception habits of young audiences, a series of content such as "technique micro-courses," "craftsman stories," and "ICH trivia" can be developed relying on mainstream media such as short videos and live streaming. Complex processes are explained through vivid and popular expressions, promoting the younger and more interesting presentation of traditional cultural content. The "Digital Heritage Guardians" team, composed of retired workers from former porcelain factories, teaches ancient Jingdezhen porcelain-making techniques through live streaming, with a maximum of 1.5 million views per session. The innovative practice of "ceramics + Internet" carried out in Jingdezhen has achieved remarkable results, with tens of millions of annual visits to online products such as digital museums, cloud exhibitions, and 3D cultural scrolls. The

integration of thematic topics through social platforms has further expanded the social influence of technique communication.

To promote the cross-regional digital cultural communication of Jingdezhen ceramic ICH, efforts are made to enhance international communication power by producing multilingual digital content and publishing it on overseas mainstream platforms. At the same time, promote the in-depth integration of digital technique content with educational scenarios, develop digital textbooks and interactive courseware suitable for primary and secondary schools as well as colleges and universities, and realize the interconnection of ceramic techniques with disciplines such as history, science and technology, and fine arts. The Ceramic ICH Digital Protection and Inheritance Women's Science and Technology Innovation Studio of the Academy of Fine Arts, Jingdezhen Ceramic University, was selected as a typical case of the joint construction of the National Women's Federation's Science and Technology Innovation Women's Action Room, demonstrating a model of integrating science and technology with humanities to promote ICH inheritance. With digitalization as the link, the studio has enabled Jingdezhen ceramic ICH techniques to shine in the new era, injecting new technological momentum into the inheritance and development of traditional techniques.

## **5.3. Digital Empowerment of Inheritance Models and Industrial Development**

Digital technology is not only used for recording and communication but can also be embedded in technique inheritance models and industrial systems, thereby realizing the living innovation of techniques and the coordinated development of industries. In terms of inheritance model innovation, digital technology can be used to develop a "digital master-apprentice system" platform, integrating online tacit knowledge databases with offline practical guidance. This allows interactions between masters and apprentices to break through geographical and temporal constraints, and the platform can provide personalized teaching and evaluation mechanisms. The "AI Clay Shaping Assistant" developed by the ICH inheritor Li Wenyue's studio can real-time correct students' gesture deviations, tripling the teaching efficiency of traditional techniques.

At the product innovation level, the integration of digital technology and traditional techniques has gradually deepened. Some workshops combine 3D printing with manual decoration, rapidly producing complex prototype shapes before manually applying glazes and color paintings. This not only reduces trial-and-error costs but also retains the warmth of handcraftsmanship. In terms of industrial empowerment, a digital ecology for the ceramic industry can be built through digital technology, integrating links such as design, production, sales, and logistics. Big data can be used to analyze market demand, providing data support for enterprise decision-making and product development. For example, Jingdezhen's Taoxichuan Cultural and Creative Block, a cultural landmark reconstructed from the site of the former state-owned Yuzhou Porcelain Factory, has built a closed-loop system of "cultural traceability - immersive experience - consumption conversion" through technologies such as blockchain, AR/VR, and the Internet of Things, becoming a benchmark case for the digital transformation of traditional industries. The team used 3D laser scanning technology to conduct millimeter-scale modeling of 22 old factories to

create a "digital kiln house," transforming the Soviet-style red brick building complex into interactive digital assets. Visitors can enter the "digital kiln house" by scanning a QR code, experiencing the entire technological evolution process from Song Dynasty dragon kilns to modern gas kilns through virtual reality technology.

The Digital Ceramic Collection Museum in the core area of Taoxichuan Block displays the world's first ceramic NFT collection—the digital version of the porcelain plate painting "A Thousand Miles of Rivers and Mountains" (a classic Chinese landscape painting representing the grandeur of nature and traditional aesthetics), created by 137 artists. Holders can participate in offline exhibition dividends through smart contracts, realizing the "materialization of digital rights and interests." Operational data shows that the museum minted 42,000 digital collectibles in the first half of its opening, driving offline exhibition visits to exceed 800,000. It is evident that using blockchain technology to achieve product traceability and ownership confirmation not only enhances brand value but also protects the rights and interests of inheritors. By promoting the in-depth integration of industry, culture, tourism, and the digital economy, and developing digital projects such as meta-universe ceramic cultural scenes, more diversified industrial development spaces can be expanded.

#### 5.4. International Comparison and Experience Reference

Compared with the digital practices of world-renowned ceramic ICH such as Japan's Arita-yaki and Germany's Meissen porcelain, Jingdezhen's digital transformation path has distinct Chinese characteristics while absorbing international advanced experiences. Japan's Arita-yaki focuses on "cultural IP digital deep cultivation," integrating ceramic techniques with youth-oriented content such as anime and games to enhance cultural identity; Germany's Meissen porcelain emphasizes the synergy between Industry 4.0 and handcraftsmanship, optimizing production efficiency and quality through digital modeling and intelligent kiln control.

Drawing on these experiences, Jingdezhen further strengthens the IP-oriented operation of ceramic culture, enriches young people's participation scenarios, and improves the standardization of technique inheritance through digital certification. At the same time, Jingdezhen adheres to its core advantages of "millennium kiln fire culture" and "comprehensive industrial ecology," avoiding excessive industrialization and maintaining the humanistic connotation of handcraftsmanship. This localized innovation combined with international experience provides a valuable reference for the digital transmission of global ceramic ICH.

## 6. Conclusion

The Digital-Intelligent Era provides an unprecedented development opportunity for the living heritage transmission of Jingdezhen ceramic ICH techniques. Technological empowerment has become the core driving force for addressing inheritance dilemmas, but the application of technology is by no means an end in itself, but a means to an end. True living heritage transmission should be the organic unity of "seeing people, seeing things, and seeing life." In the process of promoting digital transformation, we must remain

vigilant against the tendency of "technology supremacy" and avoid diluting the profound humanistic connotations of Jingdezhen ceramic ICH techniques due to an excessive pursuit of visual spectacles.

In summary, the living heritage transmission of Jingdezhen ceramic ICH techniques is a systematic project. It requires us to actively embrace digital-intelligent technology on the basis of adhering to cultural essence, further promote the in-depth integration of digital-intelligent technology with the living heritage transmission of Jingdezhen ceramic ICH techniques, and explore a path of ICH protection and development that is both in line with the characteristics of the times and embodies Chinese characteristics. In this way, the millennium-old kiln fire can continue to burn brightly in the digital space.

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