Proceedings of ICEIPI 2025 Symposium: AI Am Ready: Artificial Intelligence as Pedagogical Scaffold
DOI: 10.54254/2753-7048/2025.CB25244

Intergenerational Transmission of Digitized Intangible Cultural Heritage: A Study from the Perspective of Innovation Diffusion Theory

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Abstract. In the face of the challenges posed by the globalisation and digitalisation trends, the intergenerational transmission of intangible cultural heritage (ICH) is confronted with issues such as the ageing of heritage bearers and insufficient youth participation. However, the emergence of technologies like generative AI and the Metaverse presents new opportunities for the living transmission of ICH. Currently, the digitisation of ICH faces bottlenecks such as insufficient technical compatibility and the loss of cultural authenticity. This paper uses the theory of innovation diffusion as a framework, focusing on two aspects: 'technology bridging generational cognition' and 'digital empowerment and cultural authenticity.' Through a literature review and case analysis, it systematically explores the mechanisms by which digital technology reshapes the transmission subjects, cultural spaces, and value logic of ICH. The study found that short videos and generative AI enhance young people's participation through scenario-based narratives, but excessive entertainment can easily lead to the 'symbolic dislocation' crisis of intangible cultural heritage techniques and the rupture of cultural identity. Based on the above situation, a '3+2+1' collaborative path is proposed to construct a practical paradigm that balances innovation diffusion and cultural protection, providing theoretical and practical implications for the sustainable intergenerational transmission of intangible cultural heritage.

Keywords: Intangible Cultural Heritage (ICH), Innovation Diffusion Theory, Digitalisation, Intergenerational Transmission.

1. Introduction

Intangible cultural heritage serves as the core carrier of a nation's cultural genes—essential cultural traits transmitted across generations. However, its intergenerational transmission faces structural challenges. This crisis stems from two factors: the aging population of primary heritage bearers and the cultural disengagement among youth due to cognitive gaps and limited participation channels. The inherent closure of traditional oral-experiential transmission conflicts with the open-dissemination demands of the digital era. When combined with imbalances in technological adaptation, these challenges threaten ICH's civilizational foundations.

DOI: 10.54254/2753-7048/2025.CB25244

Meanwhile, digital technologies have profoundly transformed ICH preservation, dissemination, and innovation, driving transmission models toward virtual co-creation. Yet the linear logic of classical Innovation Diffusion Theory fails to explain bidirectional interactions in new media contexts [1]. Consequently, reconstructing intergenerational collaboration mechanisms through digital tools while balancing technological empowerment and cultural authenticity has become critical for sustainable ICH transmission.

This study adopts Innovation Diffusion Theory as an analytical framework, focusing on the tripartite synergy of technology, culture, and intergenerational dynamics. Through literature analysis, we systematically review global applications of digital technology in ICH dissemination, intergenerational conflicts, and ethical challenges. Case studies further examine how digital tools reshape relationships among heritage subjects, cultural spaces, and value systems, revealing root causes of intergenerational cognitive gaps and techno-ethical tensions. By transcending linear theoretical limitations and incorporating intergenerational cognition and tech-ethics into our framework, we construct a three-tiered model:

Layered technological adaptation.

Cultural gene preservation.

Intergenerational synergy.

This explores a digital pathway enhancing youth participation while safeguarding ICH authenticity.

The research delivers dual theoretical-practical contributions. Theoretically, by proposing ‘technological authenticity’ (defined as...) and bidirectional empowerment mechanisms, it integrates digital humanities perspectives into ICH transmission theory, shifting paradigms from instrumental rationality to value-based symbiosis. Practically, by establishing quantifiable tech-adaptation standards, intergenerational community strategies, and metaverse solutions, it provides policymakers with ethical guidelines for ICH digitization and age-friendly design standards. This enables traditional culture to achieve living heritage status in digital civilization, ultimately bridging transmission gaps and revitalizing cultural innovation.

2. Research background and significance

2.1. Current status of intergenerational transmission of intangible cultural heritage

The intergenerational transmission of intangible cultural heritage (ICH) faces serious structural challenges. The aging of primary ICH bearers is increasingly prominent, with a majority of core practitioners being elderly. Meanwhile, younger generations experience ‘cultural disconnection’ due to cognitive gaps and limited participation channels, hindering their deep understanding of ICH’s cultural significance and effective engagement in transmission practices.

The traditional oral transmission model faces dual challenges in the digital age. On one hand, its closed and regional nature conflicts with the open and instantaneous media usage habits of the younger generation; on the other hand, the logic of ICH cultural expression and the dissemination paradigms enabled by digital technology have not yet formed an effective connection. On the one hand, its closed and regional nature conflicts with the open and immediate media usage habits of the younger generation; on the other hand, the logic of intangible cultural heritage expression and the dissemination paradigms enabled by digital technology have not yet formed an effective connection. Intergenerational disconnect not only causes actual gaps in the transmission of skills but also leads to collective alienation from cultural identity, putting the survival capacity of intangible cultural heritage as a cultural gene of the nation at an unprecedented crisis.

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2.2. Opportunities and risks of digital technology empowerment

The integration of digital technology has opened up new possibilities for the intergenerational transmission of intangible cultural heritage (ICH), but it also poses potential risks of cultural deconstruction. Cutting-edge technologies such as generative AI, the metaverse, and blockchain are transforming the logic of ICH transmission. On the one hand, technological tools break through the temporal and spatial constraints of traditional transmission through scenario-based narratives and immersive experiences, offering young people low-threshold, high-interactivity participation methods; on the other hand, there is a contradiction between the instrumental rationality of technology and the value rationality of cultural heritage. Algorithm-driven traffic logic tends to simplify intangible cultural heritage techniques into symbolic fragments, weakening their cultural context and spiritual core, leading to a 'symbolic dislocation' crisis.

Additionally, technological adaptation disparities between generational groups exacerbate these contradictions. Young people's preference for entertainment-oriented expressions conflicts with the solemnity of traditional techniques, while elderly inheritors remain marginalised in technological operations, exposing generational power imbalances in digital empowerment. Technological empowerment has a 'double-edged sword' effect, requiring resolution through the dynamic balance of cultural ethics and technological rationality.

3. Literature review

3.1. Core framework of innovation diffusion theory

The digital dissemination of intangible cultural heritage has emerged as a new trend in cultural preservation and innovation, and Rogers' theory of innovation diffusion provides an important analytical framework for understanding this phenomenon. This theory indicates that innovation diffusion comprises five stages: cognition, persuasion, decision-making, implementation, and confirmation. Individuals progress from becoming aware of the innovation, forming attitudes, making choices, putting them into practice, to ultimately confirming or adjusting their decisions, thereby completing the entire diffusion process (as shown in Figure 1) [2]. In this process, both recipient variables and social system variables influence innovation diffusion. Recipient variables include personal characteristics (such as general attitudes toward change), social characteristics (such as worldism), and perceived innovation needs; social system variables include social system norms, tolerance for deviance, and the overall nature of communication. Additionally, perceived innovation characteristics, such as relative superiority, compatibility, complexity, trialability, and observability, also play a role in innovation diffusion.

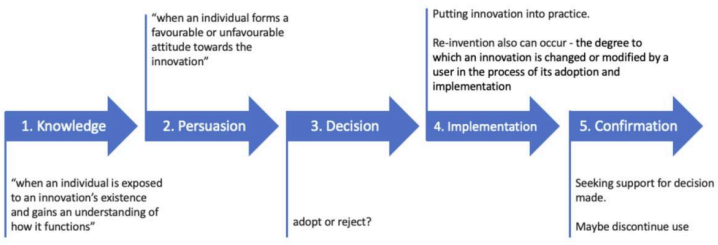

Figure 1: Rogers' description of the innovation adoption decision-making process [3]

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As shown in Figure 2, innovation diffusion follows the pattern of an adoption curve, which is slow at first. Once the number of adopters reaches a 'critical mass,' it enters a period of rapid growth, after which the growth rate slows down until the market is saturated. During the diffusion process, mass communication is responsible for widely disseminating information, while interpersonal communication plays a key role in the persuasion stage. The two complement each other, influencing the progress and effectiveness of innovation diffusion.

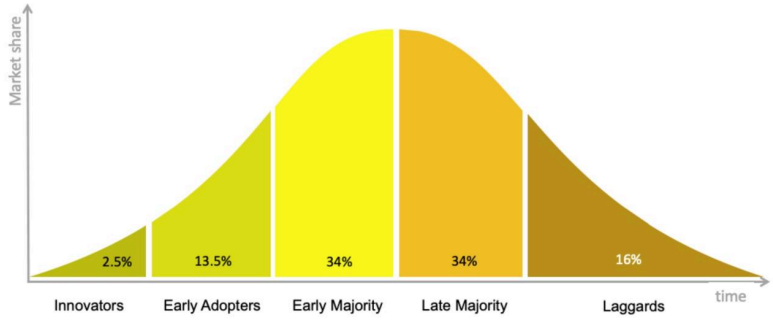

Figure 2: Rogers' adoption curve [4]

This theory provides a solid theoretical foundation for the framework constructed in the subsequent discussion. First, its stage-based classification helps analyse the behaviour and attitudes of different generational groups at various stages of the digital dissemination of intangible cultural heritage (ICH), thereby clarifying the key focus and challenges of dissemination. For example, during the awareness stage, mass communication can be used to expand the reach of digital innovation outcomes related to ICH; during the persuasion stage, interpersonal communication can be leveraged to enhance intergenerational recognition of the cultural value of ICH. Second, the S-curve pattern reveals the need to pace the dissemination of intangible cultural heritage in the digital age, focusing on cultivating seed users in the initial stage, intensifying promotional efforts during the rapid growth phase, and implementing refined operations as saturation approaches. Finally, variable analysis provides insights into how different demographic characteristics and social environmental factors influence the dissemination of intangible cultural heritage in the digital age, aiding in the development of more targeted and adaptable dissemination strategies to promote the effective inheritance and innovative development of intangible cultural heritage in the digital era.

3.2. Domestic and international research progress

3.2.1. Current state of domestic research

As related research has deepened, domestic studies have explored localised approaches to the application of digital technology in the dissemination of intangible cultural heritage and intergenerational conflicts. Deng Jianguo and Zhang Qi noted in 'Innovation, Diffusion, and Challenges of Mobile Short Videos' that Douyin's 'Intangible Cultural Heritage Partner Programme' increased the dissemination efficiency of Miao silver jewellery by 300%, but 78% of young people's secondary creations simplified cultural symbols, reflecting the inherent contradiction between technological empowerment and meaning interpretation [5]. Li Xin and Zhang Wei found in 'Path Analysis of Digital Technology Empowering Intangible Cultural Heritage Transmission' that metaverse technology increased youth participation by 45%, but due to equipment barriers, the

DOI: 10.54254/2753-7048/2025.CB25244

adoption rate among elderly inheritors was only 12%, highlighting the generational gap in technological adaptation [6]. In terms of theoretical adjustments, Wei Wenhuan emphasised age-friendly design in 'An Analysis of Rogers' 'Innovation Diffusion' Theory, suggesting that the operational complexity of intangible cultural heritage apps be reduced by 60% to enhance acceptance among the elderly [7]. Chen Xiao and Wang Lei, in "Intergenerational Digital Inclusion in Intangible Cultural Heritage Transmission: An Empirical Study Based on Co-creation of Short Videos on "Zhejiang-Fujian Wooden Arch Bridge Construction Techniques," using the Zhejiang-Fujian region as a case study, found that young people used short video 'symbolic translation' to deconstruct mortise-and-tenon structures with 3D animations, lowering the cultural cognitive barrier. However, 37% of elderly inheritors believed that the 'spirit of craftsmanship was being eroded.' The study proposed the 'Intergenerational Digital Inclusion Index' (IDII) to quantify collaborative effectiveness [8]. Huang Xiaoyang and Zhou Xiaohong, in their study titled 'Intergenerational Cognitive Bias in Intangible Cultural Heritage Short Videos Under Algorithm Recommendation Mechanisms: A Case Study of "Suzhou Embroidery" on Douyin,' analysed 120,000 video data points and found that algorithms push more 'national trend design' content to young users and more 'technique instruction' content to middle-aged and elderly users, exacerbating the 'echo chamber' effect in intergenerational cultural cognition. They suggested establishing a 'non-heritage content grading label database' [9]. Liu Yang and Li Siyu, in their study 'A Comparative Analysis of Intergenerational Inheritance Models for Non-Heritage Digitalisation Between Eastern and Western Regions: A Case Study of Gansu Incense Bags and Hangzhou Silk,' compared and found that western regions in China rely on government-led technical training, while eastern regions focus on market-driven youth entrepreneurship. They innovatively proposed a 'regional-intergenerational' dual-dimensional adaptation model [10].

3.2.2. Current state of overseas research

Overseas research offers cross-cultural insights into technological ethics and intergenerational memory. Kim notes in 'Digital Heritage and Intergenerational Transmission' that the 'Ancestral Shrine Ritual VR Restoration' project in South Korea invited young people to participate in the design of virtual ritual objects, resulting in a 65% increase in intergenerational awareness of traditional rituals. This demonstrates that, with technological empowerment, young people can transition from being 'cultural consumers' to 'co-creators of meaning' [11]. However, Manovich in Software Defines Everything highlights the potential risks of algorithmic recommendations, pointing out that the 'entertainment-oriented content bias' on YouTube's intangible cultural heritage channels has reduced the traffic share of serious craft-related videos to 19%, exacerbating the tendency toward superficial cultural interpretation [12]. Additionally, Smith and other scholars in *Measuring Authenticity in Digital Heritage Interventions: A Mixed-Methods Framework Balancing Innovation and Preservation* developed an evaluation framework combining quantitative indicators and qualitative analysis, using the British Museum's AR guided tour project as an example, validating the measurability of 'dynamic authenticity' under technological intervention and providing methodological references for establishing standards that harmonise technology and authenticity [13]. Fernández-Llamas et al., through a five-year case study of Canadian Indigenous communities, proposed the 'dual-path model' and 'cultural-technological trust index' in 'Maintaining Intergenerational Participation in Digital Heritage: A Five-Year Case Study of Youth-Led Co-Creation in Indigenous Communities,' revealing the key elements of a sustainable intergenerational technology feedback mechanism [14]. Zhang and Liu, in 'East-West Clashes in Digital Heritage Dissemination: Differences in Memory Preservation Strategies on TikTok and

DOI: 10.54254/2753-7048/2025.CB25244

Instagram,' compared Eastern and Western dissemination models, identifying the strategic divide between Eastern 'ritualistic participation' and Western 'individual narrative,' and emphasising the joint shaping effect of algorithmic logic and cultural context on dissemination outcomes [15].

3.2.3. Research gaps

Currently, domestic research has delved beyond the superficial application of technology to explore deeper contradictions such as intergenerational cognition, algorithmic ethics, and regional differences. Overseas research has also provided diverse perspectives and empirical evidence for the theoretical construction and practical optimisation of intangible cultural heritage digitalisation through dimensions such as intergenerational collaboration, technological ethics, and cross-cultural comparisons. While validating the dissemination efficacy of technology-enabled approaches, these studies have also revealed practical challenges such as the loss of cultural authenticity and intergenerational power imbalances, providing multi-dimensional empirical evidence for the construction of a localised model integrating 'technology adaptation—cultural preservation—intergenerational collaboration.'

However, existing research lacks quantitative standards for the synergy between technology-enabled approaches and cultural authenticity, making it difficult to measure the extent to which technological applications impact cultural authenticity. The long-term mechanisms for intergenerational technological feedback have not been effectively validated, and sustainable intergenerational interaction patterns have not yet been established. Additionally, comparative studies between Chinese and Western communication models are insufficiently in-depth, failing to provide precise references for local communication practices. Future research could construct a three-dimensional model of 'technology-cognition-ontology' to transcend the limitations of instrumentalism, exploring sustainable pathways that both utilise technology and protect cultural heritage, thereby providing theoretical support for intergenerational communication of intangible cultural heritage in the digital age.

4. Innovative pathways for the digital transmission of intangible cultural heritage: the '3+2+1' practical paradigm

Addressing core issues in the digitalisation of ICH, such as technological mismatches, loss of cultural authenticity, and intergenerational collaboration gaps, the '3+2+1' collaborative approach is proposed. This involves establishing a three-dimensional foundation of 'digital media + cultural genes + intergenerational co-creation,' setting technical compatibility standards, and implementing a dual-mechanism for cross-generational digital community operations. Additionally, a metaverse immersive interaction platform serves as the spatial carrier to address the symbiotic relationship between technological empowerment and cultural heritage preservation.

4.1. Three core foundations

In terms of digital media, provide tiered technologies to meet intergenerational needs. For younger audiences, develop low-threshold, highly interactive digital tools. For elderly inheritors, prioritise the development of technologies that preserve authenticity, safeguarding the 'genetic code' of cultural heritage during technological empowerment.

In terms of cultural genes, establish mechanisms to protect the core essence of intangible cultural heritage, clarifying the principle that techniques and symbols must not be diluted. For example, in

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the case of Shaanbei paper-cutting, industry associations and platforms have jointly stipulated that the proportion of traditional patterns retained in creations must not be less than 80%, and folk stories must be added to the description area to prevent techniques from becoming mere visual symbols. This rule enhances young users' understanding of the cultural implications of paper-cutting, ensuring that technological innovation serves to deepen the dissemination of cultural content rather than deconstructing its form.

In terms of intergenerational co-creation, a mutually empowering collaborative mechanism should be established to break the one-way penetration model of technology. Senior artisans lead the interpretation of core techniques, while young teams are responsible for interaction design, forming an intergenerational symbiotic model where experience has a carrier and innovation has a direction. This allows traditional techniques to regain their dissemination momentum through digital media.

4.2. Dual-drive mechanism

Establish a full-process ethical framework based on technical adaptation standards to ensure that technology applications are consistent with the characteristics of intangible cultural heritage inheritance. Through intergenerational operation of digital communities, cultivate a cultural co-creation community and build a three-party collaborative digital community. Promote intergenerational interaction through division of labour mechanisms and incentive strategies, forming a co-creation loop that strengthens community cohesion and encourages young people to transition from observers to disseminators, thereby constructing an intergenerational shared cultural meaning production network.

To ensure that technology applications align with the characteristics of intangible cultural heritage preservation, we rely on technology adaptation standards to establish an end-to-end ethical framework. For example, by operating digital communities across generations, we cultivate a cultural co-creation community. We create a digital community comprising three collaborative parties: ‘master craftsmen + young creators + ordinary users.’ Through division of labour mechanisms and incentive strategies, we promote intergenerational interaction. Form a co-creation closed loop of ‘skill transmission—technological implementation—user participation’ to enhance community cohesion. Transform young people from bystanders into disseminators, thereby constructing a generational network for the production of shared cultural meaning.

4.3. A core scenario

Utilising metaverse technology, a new ‘virtual-physical integration’ scenario for the dissemination of intangible cultural heritage has been established, thereby upgrading cultural spaces from physical presence to digital symbiosis. The Jingdezhen Ceramic Metaverse Workshop uses VR technology to recreate the entire process of ‘mining—kneading clay—shaping the clay—firing the kiln’ in a 1:1 scale. Users can operate virtual clay with their own hands simply by wearing the relevant equipment. Some participants noted that it was their first time understanding the technical challenges behind the art. This has driven an increase in foot traffic at Jingdezhen Ceramic offline experience stores, achieving a cognitive leap from observation to practice.

A cultural element monitoring system is embedded in the scene operation, real-time analysing the proportion of traditional elements in users' creative content. This “immersive experience + data-driven detection” scene model not only meets the younger generation's demand for interactivity and novelty but also provides elderly inheritors with a transcendent space for skill transmission, achieving a creative transformation of intangible cultural heritage spaces in the digital age.

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5. Conclusion

Digital technology plays a clear ‘double-edged sword’ role in the intergenerational transmission of intangible cultural heritage (ICH). On the one hand, technologies such as short videos and the metaverse offer young people low-threshold, high-interactivity participation pathways through scenario-based narratives and immersive experiences, effectively expanding the reach and appeal of ICH dissemination. On the other hand, the instrumental rationality of technology may lead to the simplification of the cultural context and spiritual core of ICH techniques, causing dissemination biases. The differences in technological adaptation between generations and the cultural cognitive gap further exacerbate the structural contradictions within the inheritance system.

This paper breaks through traditional theoretical frameworks by incorporating intergenerational cultural cognition and technological ethics into the analytical system, thereby enriching the theoretical perspective on the digital transmission of ICH. Additionally, by establishing technological adaptation standards and intergenerational collaboration models, it provides practical guidance for ICH protection practices. The proposed ‘3+2+1’ collaborative pathway, through technical layered adaptation, cultural gene protection, and intergenerational two-way co-creation mechanisms, establishes a practical paradigm that balances innovation diffusion efficiency with cultural authenticity, offering a systematic solution to address the intergenerational disconnect in ICH.

In summary, collaborative mechanisms can both leverage the dissemination potential of digital tools and mitigate the risks of cultural alienation. Future research will continue to focus on the refined construction of technological ethics, explore sustainable mechanisms for intergenerational collaboration, and strengthen comparative studies of digital dissemination models for ICH across different cultural contexts. This will further refine the theoretical and practical framework for the synergistic development of ‘technology-culture-intergenerational’ collaboration, driving the long-term preservation of ICH in the digital age as both ‘vibrant and authentic.’

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DOI: 10.54254/2753-7048/2025.CB25244

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