



RESEARCH ARTICLE

MULTI-DIMENSIONAL INNOVATIVE REVITALIZATION OF LIN ZEXU'S CULTURAL HERITAGE EMPOWERED BY DIGITAL TECHNOLOGY

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ARTICLE INFO	ABSTRACT
<p>Submission Aug., 05, 2025</p> <p>Acceptance Aug., 09, 2025</p> <p>Keywords</p> <p>Digital technology; Lin Zexu cultural heritage; Heritage revitalization; Digital empowerment</p> <p>Corresponding Author</p> <p>704262728@qq.com</p>	<p>This paper focuses on the critical issue of revitalizing Lin Zexu's cultural heritage through the empowerment of digital technologies. We combine the national cultural digitization strategy with the regional cultural protection needs of Fuzhou, analyzing the current state of Lin Zexu's cultural heritage, identifying the challenges in its revitalization process, and proposing recommendations for its revitalization. First, we review the current state of Lin Zexu's cultural heritage in Fuzhou, including its composition and spatial characteristics, the status of preservation and restoration, and the state of academic research and digital construction. Next, we analyze the challenges encountered during the revitalization of Lin Zexu's cultural heritage from six dimensions: spiritual connotation, digital technology, data resources, social participation, long-term mechanism, and talent assurance. Finally, based on the challenges identified, we draw on the 4T (Technology, Targeted, Talent, Transcendent) model and revitalization methods (industrial revitalization, tourism revitalization, social work revitalization) to propose multi-dimensional innovative revitalization suggestions, such as building a spiritual decoding system, developing emotional digital narrative products, deepening the integration of digital technologies, establishing technical adaptation strategies, creating an all-domain digital resource platform, co-building data alliances and standards, innovating public participation mechanisms, promoting integration with short video platforms, innovating investment and financing mechanisms, establishing long-term mechanisms, and accelerating the cultivation of compound talents.</p>

1. INTRODUCTION

In recent years, the revitalization of cultural heritage has become an increasingly prominent

focus in academic, policy, and public discourse (Xiao, 2022; Zhao & Kim, 2025). Wang & Zaibon (2024) reviewed the policy framework for the protection of intangible cultural heritage in China and raised several challenges faced in the implementation of these policies. In the context of national strategies emphasizing cultural confidence and digital transformation, the revitalization of cultural heritage has become even more important. Among China's many historical figures, Lin Zexu stands out as a pivotal symbol of patriotism, moral resolve, and global vision. As the architect of the historic destruction of opium and a trailblazer in engaging with the world during the late Qing dynasty, Lin Zexu's legacy is not only a critical part of modern Chinese history but also an invaluable resource for public education, cultural identity, and international understanding.

Lin Zexu's cultural heritage in Fuzhou comprises a dense cluster of physical sites, documents, artifacts, and public memory networks. These sites, including his birthplace, former residence, and memorial hall, are highly valued by local and national authorities. Moreover, like many heritage clusters rooted in traditional museum-based narratives, they face mounting challenges amid evolving audience expectations, spatial limitations, and technological disruptions. Kwong (2008) explored Lin Zexu's Anti-Opium Campaign of 1839. Chen (2017) conducted a study of Lin Zexu's translation activities from an ideological perspective. Zhang et al. (2024) studied the spatial and temporal aggregation and corridor distribution characteristics of Fuzhou's cultural heritage.

At the same time, the rapid development of digital technologies, such as artificial intelligence (AI), virtual and augmented reality (VR/AR), big data, cloud computing, and digital twins, has opened new frontiers for cultural production, dissemination, and engagement (Liritzis et al., 2015; Liu, 2022; Portalés et al., 2018; Zhu & Liu, 2025). These technologies are not merely tools for documentation; they offer immersive, intelligent, and participatory environments that can bridge the gap between historical legacy and contemporary relevance (Georgopoulos, 2018; Giglitto et al., 2019; Pouloupoulos & Wallace, 2022). In this context, the concept of heritage revitalization has shifted from static preservation to dynamic recreation, emphasizing creative transformation and innovative development grounded in emotional resonance and multidimensional value expression.

This paper takes the case of Lin Zexu's cultural heritage as a focal point to explore the multi-dimensional revitalization potential enabled by digital technology. It aims to answer several interrelated questions: How can cutting-edge digital resources be effectively integrated to transcend the limitations of traditional heritage utilization? What kinds of narrative frameworks, participatory mechanisms, and technical strategies are needed to foster deeper public engagement—particularly among youth? And how can Lin Zexu's historical significance be translated into an accessible, resonant cultural experience in the digital age?

Drawing on the 4T model (Technology, Targeted, Talent, Transcendent) and grounded in empirical analysis of Lin Zexu's heritage ecosystem in Fuzhou, this study offers a systematic examination of current challenges, analyzes the opportunities presented by digital empowerment, and proposes an integrated, multi-path framework for sustainable and innovative heritage revitalization. Its findings not only enrich the research on Lin Zexu and cultural memory but also contribute a transferable model for similar historical figures and cultural heritage projects facing the pressures and potentials of the digital era.

2. CURRENT STATUS OF LIN ZEXU'S CULTURAL HERITAGE

We summarize the current state of Lin Zexu's cultural heritage from the following perspectives.

2.1. Composition and Spatial Characteristics of the Heritage

Within the city of Fuzhou, Lin Zexu's cultural heritage is centered around the nationally protected cultural site Lin Zexu's Residence and Ancestral Hall, forming a spatial layout characterized by three interconnected points radiating outwards across the city. The core heritage sites include Lin Zexu's birthplace (Zhongshan Road, Gulou District), his former residence (Wenbei Road, Gulou District), and the Lin Zexu Memorial Hall (Macau Road, Gulou District). All three are nationally protected cultural sites and were jointly listed in 2013 as part of the seventh batch of National Key Cultural Relics Protection Units under the title "Lin Zexu's Residence and Ancestral Hall." Penića et al. (2015) explored methods of revitalizing historic buildings to protect cultural and historical heritage. Some studies discuss cultural heritage preservation and urban renewal (Bizzarro & Nijkamp, 1998; Knippschild & Zöllter, 2021).

The Lin Zexu Literature Museum in Fuzhou holds nearly 4,000 books related to him, including manuscripts, memorials to the throne, and family letters, and is gradually advancing digitization efforts. Additionally, memorial institutions in other regions, such as the Lin Zexu Memorial Park in Guangzhou, the Lin Zexu Memorial Museum in Suzhou, the Lin Zexu Memorial Hall in Pucheng (Shaanxi), and the Beijing Fuzhou Guild Hall (Lin Zexu Anti-Drug Education Base), collectively form a nationwide commemorative network.

The three major heritage sites in Fuzhou are compactly located and functionally complementary. All are within a 3-kilometer radius in Gulou District and are accessible by foot from the Sanfang Qixiang Historic and Cultural District, forming a cultural circle. During the Spring Festival in 2025, the Lin Zexu Memorial Hall saw more than 30,000 visitors in a single day, with a total of 486,000 visitors in January and February, showcasing strong cultural vitality and forming a dense cultural cluster. From a functional perspective, the birthplace emphasizes biographical commemoration, the former residence focuses on literature collection and research, and the memorial hall prioritizes public education. Together, the three form a complementary "commemoration-research-education" network.

2.2. Status of Preservation and Restoration

The protection of Lin Zexu's cultural heritage is based on archaeological research and supported by policy frameworks, resulting in a multi-level protection system. Regarding archaeology and scientific restoration, the second phase of restoration work on Lin Zexu's former residence involved systematic archaeological investigation, identifying the foundational structures of the entrance hall, first and second courtyards, and discovering key artifacts such as Song dynasty ceramic water pipes and Ming-Qing era inscribed bricks, providing scientific evidence for accurate reconstruction. By May 7, 2025, the full restoration of the residence had been completed, and the site began trial operations.

On the policy and funding front, Fuzhou has incorporated the protection of Lin Zexu's heritage into its strategy to strengthen the city's cultural influence. The 2025 government work

report specifically mandated the successful organization of the 240th anniversary of Lin Zexu's birth, and the city allocated special funds to support the restoration of his residence and upgrades to the memorial hall's exhibitions.

2.3. Academic Research and Digital Construction

Academic research and value excavation of Lin Zexu's cultural heritage follow a dual approach: textual collation and digital transformation. The Lin Zexu Memorial Hall, in cooperation with the Fuzhou Library, has commissioned professional institutions to digitize rare books, manuscripts, and hand-copied documents, establishing a specialized literature database to address the conflict between preservation and utilization of aging documents. Based on the "Seventy-Two Peaks Pavilion" in his former residence, the center collects ancient books, manuscripts, and monographs, covering topics such as the Opium War and early modern hydraulic engineering archives, and is building a national-level Lin Zexu Research Center.

The commemorative exhibition held in 2025 showcased for the first time a collection of nearly four thousand words of letters written by Lin Zexu, covering topics such as grain transportation and local governance in the Jiangnan region. Currently, this is the longest surviving letter known to have been written by Lin Zexu and is of great historical value.

In terms of digital construction, efforts currently focus on digitizing literature and multimedia presentations. High-precision digital collection methods (e.g., 3D scanning and HD photography) are used to create digital archives of artifacts, documents, images, and architecture. Multimedia technologies (touch screens, projections, animations) enhance exhibition formats and interactive experience projects to improve visitor engagement. Smart guide devices or mobile apps offer features like QR code scanning for audio explanations, exhibit information, and route planning, enhancing the convenience and personalization of visits. Emerging digital technologies such as AI-powered virtual guides are also under exploratory implementation.

3. CHALLENGES IN THE REVITALIZATION OF LIN ZEXU'S CULTURAL HERITAGE

Despite significant progress in the preservation and revitalization of Lin Zexu's cultural heritage, several systemic challenges remain.

3.1. Spatial Constraints and Uneven Value Interpretation

First, there are bottlenecks in the physical space that hosts the heritage. The core sites, including Lin Zexu's birthplace, former residence, and memorial hall, are all located in Fuzhou's old town (Gulou District) and are relatively small in scale (e.g., the residence covers only 720 square meters), with limited room for expansion. During the 2025 Spring Festival peak, daily visitor numbers exceeded 30,000, far surpassing the sites' carrying capacity and negatively affecting the visitor experience. Although these sites are within walking distance of each other, their functions are fragmented: the memorial hall focuses on exhibitions, while the residence concentrates on document preservation, with no unified narrative structure, making it difficult for visitors to form a coherent understanding.

Second, the interpretation of heritage values is imbalanced. Current revitalization efforts overly emphasize Lin Zexu's anti-opium actions and the Humen Opium Destruction narrative, while insufficient attention is given to his contributions in water governance (e.g., Yellow River

management and the dredging of Fuzhou's West Lake), family ethics (e.g., the practice of Ten Unbeneficial Habits), and diplomatic thought (e.g., the compilation of Illustrated Four Continents). This limits the contemporary relevance and transformative potential of his legacy.

3.2. Inadequate Depth of Digitalization and Virtual-Physical Integration

First, the application of digital technologies remains superficial. Current digitalization efforts are largely limited to scanning and archiving (e.g., digitizing manuscripts) and lack advanced tools such as AI-based interpretation or knowledge graph construction. Key texts like the Illustrated Four Continents have not yet been linked to broader frameworks of modern intellectual history.

Second, the integration of virtual and physical spaces is insufficient. Existing digital tools primarily rely on multimedia and projection technologies and are not effectively embedded in physical exhibitions. This has prevented the formation of a seamless feedback loop between physical participation and virtual extension, and digital experiences have yet to be incorporated into permanent exhibition routes.

Third, data resource integration remains weak. Databases for the former residence, artifact archives from the memorial hall, and catalogues from the calligraphy and painting academy remain siloed, forming data silos that constrain the development of a unified cloud-based platform for Lin Zexu's cultural heritage.

3.3. Limited Audience Engagement and Weak Cultural Industry Integration

First, educational revitalization remains homogeneous. Current practices rely heavily on unidirectional approaches such as docent-guided tours and moral education courses, lacking the co-creative and interactive formats favored by younger audiences. This results in low youth participation and a small proportion of young visitors.

Second, the integration between cultural heritage and tourism industries remains shallow. The development of cultural and creative products is slow, with no iconic outputs akin to the brand of Palace Museum Cultural Creativity. Existing souvenirs are mainly limited to books and reproductions of calligraphy or paintings, generating limited revenue. In-site experiences are relatively shallow, often restricted to exterior architecture and basic storytelling. Augmented reality (AR) and similar technologies have yet to be fully applied to recreate historical scenes or improve immersion and interactivity.

3.4. Operational Models and Talent Development Require Innovation

First, sustainable operations face pressure. The current revitalization and operation of Lin Zexu's cultural heritage rely primarily on government funding, with limited public participation. Market-driven approaches, such as creative product development and intellectual property (IP) commercialization, have yet to form a complete cycle, and a mature market-oriented operation model is still lacking.

Second, there is a shortage of skilled professionals. There is a lack of interdisciplinary talent proficient in cultural preservation, exhibition planning, digital technology, and educational communication. The volunteer system remains underdeveloped, and collaboration between

historians and digital technologists is insufficient, sometimes leading to historical inaccuracies.

4. ADVANTAGES AND LIMITATIONS OF DIGITAL TECHNOLOGY IN EMPOWERING LIN ZEXU'S CULTURAL HERITAGE REVITALIZATION

Digital technologies offer significant advantages in revitalizing Lin Zexu's cultural heritage and can effectively address many of the current challenges.

First, digital tools can overcome physical space limitations. Technologies such as virtual museums can expand display capacity, while data analytics can reveal deeper layers of heritage value, thus balancing spatial constraints with value expression. Second, technologies such as artificial intelligence and big data enable in-depth mining of heritage content. Immersive virtual experience projects allow audiences to engage with history firsthand, enhancing the integration of the virtual and physical, and deepening digital applications. Third, through the internet and mobile platforms, digital dissemination can reach broader and more diverse audiences, particularly attracting younger generations. Combined with the cultural and tourism industries, digital innovation can foster the development of creative products and online tourism routes, injecting new energy into industrial growth and improving both audience reach and economic impact. Fourth, digital management platforms can optimize operational workflows and increase efficiency. Online training programs and simulation-based internships can cultivate interdisciplinary professionals who understand both cultural heritage and digital technologies, thereby fostering innovation in operational models and professional development.

However, the application of digital technologies in the revitalization of Lin Zexu's cultural heritage still faces several key issues. These challenges must be systematically analyzed across six dimensions: digital technology, cultural interpretation, copyright management, sustainable development, talent assurance, and public participation. It helps us to identify and resolve the main bottlenecks in implementation.

4.1. Challenges in Spiritual Interpretation and Expression

First, the deconstruction of Lin Zexu's core spirit remains insufficient. Current digital displays often focus narrowly on his anti-opium achievements, while other important aspects are marginalized, such as his contributions to water governance and frontier development. These reflect his pragmatic and responsible character, yet the complex historical context of his spiritual development is often ignored. Under traditional exhibition modes, key values like patriotism (such as devotion to the nation above personal fate) and openness (such as learning from the West) are frequently reduced to slogans, lacking deeper explanation of their origins or relevance today. Especially for younger audiences, abstract value transmission fails to generate emotional resonance or behavioral identification, limiting educational effectiveness.

Second, modes of presentation remain limited. Contemporary expressions of Lin Zexu's spirit are often conceptual or symbolic, lacking vivid, emotional, and experiential formats. Most digital exhibits still rely on static images or one-way video presentations, failing to creatively interpret or deeply explore his spiritual legacy through technology. His multifaceted character, such as embodying loyalty, righteousness, courage, and wisdom, is usually flattened into a single heroic narrative, lacking a structured spiritual framework. Moreover, emotional engagement is underdeveloped. His heartfelt family letters and his struggles during exile, which carry strong

emotional weight, are rarely utilized in digital storytelling.

4.2. Shallow Application and Limited Adaptation of Digital Technologies

First, technological application in Lin Zexu's heritage projects remains superficial. Digital exhibits at the Lin Zexu Memorial Hall often follow a standardized model, such as 3D screens and basic multimedia displays, but lack tailored solutions reflecting local cultural features. In terms of educational transformation, the focus tends to be on sensory stimulation rather than internalization of values. Anti-drug education for youth still emphasizes warning about harm, neglecting Lin Zexu's forward-looking "eyes-open-to-the-world" mindset.

Second, there is insufficient adaptation between digital technologies and Lin Zexu's cultural heritage. Heritage projects require highly customized technical solutions, but commercial enterprises are reluctant to tailor products for individual projects due to high costs, reducing technological suitability. Furthermore, there is no clear framework for selecting digital technologies based on the type of heritage involved. More research is needed to match specific technologies with different forms of heritage.

4.3. Fragmented Data Resources and Lack of Unified Standards

First, data resources related to Lin Zexu's heritage are fragmented. Digital resources remain dispersed, and there is no effective mechanism for resource integration or sharing. Spatially, artifacts and documents related to Lin Zexu are housed in multiple regions, such as Fuzhou, Yili, and Humen. Although the Fuzhou Lin Zexu Literature Museum holds nearly four thousand volumes, digitization progress is slow, and mechanisms for interregional sharing are lacking.

Second, data standards are inconsistent. The collection and integration of data require unified specifications. Lin Zexu's heritage spans various categories (such as literature, architecture, artifacts) scattered across different locations, posing challenges to data acquisition. There is no consistent standard or technical interface between traditional materials like manuscripts and memorials, and modern formats like digital animations and holographic images. Differences in scanning resolution, data formats, and metadata protocols create data silos, hindering efficient resource utilization.

4.4. Limited Social Participation and Weak Communication Channels

First, public participation remains low. Although digital technology provides more opportunities for public engagement, actual enthusiasm and initiative are lacking. Public understanding of Lin Zexu's spirit is often limited to textbook knowledge, and digital outreach relies heavily on official social media, lacking interactive features. Public interest in or awareness of digital revitalization projects is weak, limiting their broader influence.

Second, communication channels and effectiveness are limited. While the internet and new media offer expansive platforms for cultural dissemination, it remains difficult for digital content about Lin Zexu's heritage to stand out and attract significant attention. Youth audiences prefer immersive and deconstructive storytelling, but current digital offerings fail to incorporate gamification or social interaction, leaving innovative formats largely unexplored. Dissemination channels are insufficiently diversified, and communication results fall short of expectations, limiting the advantages digital technology could bring to cultural transmission.

4.5. Funding Limitations and Incomplete Long-term Mechanisms

First, full-cycle funding costs are high. Digital transformation, from data collection and processing to platform development, operation, and maintenance, requires significant investment. Large-scale heritage revitalization projects, such as immersive experience centers or complex digital applications, demand especially high funding. Most projects still rely on government support, while private investment is limited due to long return cycles. A coordinated “government-market-society” funding model is yet to be formed.

Second, long-term mechanisms are underdeveloped. Current digital projects lack a sustainable return path. Although some digital collectible initiatives have been piloted, blockchain authentication and revenue distribution mechanisms are still immature, preventing a closed loop where digital asset income supports physical heritage conservation. Moreover, Fuzhou's Lin Zexu heritage projects are not yet capable of industrial transformation. Cultural-tourism integration remains at basic levels such as AR guides, lacking an IP-driven industry chain. Cultural resources have yet to be translated into economic value, and creative derivative products are insufficient to reinvest in heritage protection.

4.6. Difficulty in Cultivating and Attracting Interdisciplinary Talent

First, there is a shortage of interdisciplinary professionals. Revitalizing cultural heritage through digital technology requires talent with expertise in both heritage conservation and digital tools. Currently, such professionals are scarce, hindering project implementation. For instance, designing digital displays for Lin Zexu's heritage requires individuals who understand his historical and cultural background and can use technologies such as VR and AR for creative design. However, it is often difficult for one person to possess all of these skills.

Second, talent cultivation and recruitment are difficult. Developing interdisciplinary talent takes significant time, effort, and resources. Related academic programs and educational systems are not yet fully developed. Fuzhou also faces stiff competition from larger cities in attracting high-end digital and cultural heritage experts, making talent recruitment even more challenging.

5. SUGGESTIONS FOR DIGITALLY EMPOWERED REVITALIZATION OF LIN ZEXU'S CULTURAL HERITAGE

While digital technology presents powerful tools for revitalizing Lin Zexu's cultural heritage, mere static or rigid forms of preservation are inadequate. Instead, strategies such as industrial revitalization, tourism revitalization, and social work-based revitalization offer integrated approaches that balance economic and social benefits. Drawing on the China Cultural Heritage Digitization Research Report, particularly its 4T innovation model (Technology, Targeted, Talent, Transcendent), and successful practices in other regions, this paper proposes the following strategies to guide the innovative and multidimensional revitalization of Lin Zexu's cultural heritage through digital technology.

5.1. Build a Spiritual Decoding System and Develop Emotionally Engaging Digital Narratives

First, establish a four-dimensional spiritual coordinate framework. Use AI-based deep semantic analysis to process Lin Zexu's memorials, family letters, and poetry, identifying

emotional patterns and reconstructing historical contexts to extract core values: loyalty, righteousness, courage, and wisdom. Employ natural language processing to create a structured, annotated database that categorizes these spiritual traits. Develop a dynamic visualization platform (the Lin Zexu Spiritual Atla) which transforms abstract values into interactive digital symbols. Flagship initiatives such as a Digital Family Code project could include animated shorts or AR-powered community apps that allow residents to view family stories by scanning neighborhood bulletin boards, embedding cultural values in daily life.

Second, develop emotionally rich digital storytelling products. Drawing inspiration from Dongguan “Lin Zexu 1839” special-effects performance, use narrative strategies from the perspective of ordinary people (such as fishermen, craftsmen) to reflect Lin Zexu’s values and increase emotional connection. Create an immersive theater experience titled *A Day in the Life of Lin Zexu*, allowing visitors to inhabit his perspective, face moral dilemmas, and feel his internal struggles. Leverage AR technology to build interactive installations that immerse users in Lin Zexu’s patriotism and anti-opium efforts. By blending historical reenactment, interactive games, and educational content, the heritage site becomes more attractive. In schools, launch a “Lin Zexu Spirit Digital Ethics Kit” that uses VR to recreate key historical scenes and reinforce affective learning.

5.2. Deepen Digital Integration and Develop Tiered Technology Adaptation Strategies

First, promote the tailored integration of digital technologies with Lin Zexu’s heritage. Use generative AI restoration tools to recreate original manuscripts, paired with stroke evolution simulation techniques to reflect his thought processes. For water governance heritage, build a Hydraulic Wisdom Knowledge Graph to offer insights into modern flood prevention efforts. In education, design branching storyline simulations where students role-play in decision-making during the 1839 opium suppression, experiencing the historical complexities involved. Drawing from VR anti-drug education platforms, add immersive modules based on Lin Zexu’s *Illustrated Treatise on the Maritime Kingdoms* to highlight his open-mindedness.

Second, create a tiered strategy for technological adaptation. Tailor digital applications to the type of heritage involved. For commemorative documents such as letters, interactive digital family letters can be created using artificial intelligence text analysis and stroke reconstruction technology, and support can be provided through educational applications. For architectural heritage like his residence and ancestral hall, refer to the Sanfang Qixiang digital restoration model, which could employ laser scanning and BIM modeling with AR scene overlays. Inspired by Nanjing Yangtze River Bridge’s metaverse project, use digital twin modeling and real-time 3D rendering to build a cloud-based Lin Zexu Heritage Space for immersive virtual experiences.

5.3. Build a Comprehensive Digital Resource Platform and Co-develop Data Alliances and Standards

First, construct a comprehensive digital resource platform. Under the coordination of Fujian’s Department of Culture and Tourism, partner with institutions in Yili, Guangdong (Humen), and other regions to build a Lin Zexu Digital Memory Bank. This would integrate nearly 4,000 volumes from the Fuzhou Literature Museum, scanned artifacts from Yili, and video resources from Dongguan’s anti-opium reenactments. The platform should serve dual purposes:

academic research and industrial application. On the academic side, open AI research interfaces for studies such as semantic analysis of Lin Zexu's spirit. On the industrial side, offer standardized data packages to lower development costs. Use blockchain, in cooperation with institutions like the Fujian Strait Blockchain Research Institute, to implement inter-institutional copyright accounting and incentivize data sharing.

Second, establish data alliances and common standards. Following the model of the Dunhuang cultural heritage digitization system, work with the Fujian Museum and provincial archives to create a Lin Zexu Cultural Heritage Data Hub and draft unified protocols such as the Lin Zexu Heritage Digital Collection Standards. These should regulate technical parameters such as 2D scan resolution, 3D modeling error margins, metadata structures, and format specifications. Provide distributed collection kits, including portable scanning devices and standardized data-entry templates, empowering local preservation teams for collaborative data collection.

5.4. Innovate Public Participation Mechanisms and Integrate with Short-Form Video Platforms

First, design diversified public participation mechanisms. Launch a platform to recruit youth teams for developing Lin Zexu-themed mini-games, with competitions to select outstanding entries. Promote Fuzhou's scenario-based cultural tourism model by deploying AR apps in landmarks like Sanfang Qixiang, allowing visitors to activate historical event re-creations through real-world scans. Create youth-targeted content such as history vlogs that explain Lin's anti-opium efforts, or produce graphic novels and animations that link his civil service journey to modern educational values. Promote home-school-community collaboration through animated adaptations of Ten Unbeneficial Habits in school moral education programs.

Second, encourage deep integration with short-form video platforms. Leverage the advantages of short videos in terms of speed, reach, and interactivity to transform the way Lin Zexu's legacy is disseminated. Develop a series of high-quality, emotionally engaging short videos to convey Lin Zexu's patriotism, integrity, and global vision. Launch community-wide contests (e.g., Discover the Lin Zexu Spirit Around You) to attract broader engagement in heritage revitalization. Support collaborations between museums and top short-video creators to ensure a balance between professional authority and popular appeal.

5.5. Innovate Investment and Financing Models and Improve Long-Term Mechanisms

First, diversify funding sources and attract private investment. Establish the "Fuzhou Lin Zexu Heritage Revitalization Industry Guidance Fund" to mobilize private capital. Use government guidance, industrial investment, and project partnerships to enable diversified funding and sustainable development. Begin with lightweight pilot projects that show commercial potential, particularly in digital IP incubation. Explore interregional cultural industry cooperation to achieve financial synergy and regional cultural-economic prosperity.

Second, strengthen economic feedback loops and build an industrial ecosystem. Create a closed-loop model where digital copyrights support physical heritage protection. Digitally restored manuscript animations can be verified on blockchain and released as limited-edition collectibles, with smart contracts directing profits into artifact conservation funds. Develop an integrated cultural-tourism industry chain; for instance, following Dongguan's Humen special-

effects show, design a Fuzhou version (such as “Lin Zexu and the Min River”) linking heritage sites into an educational tourism route. Set up the “Lin Zexu Digital Conservation Fund” to support R&D and IP incubation, prioritizing projects with both social and economic benefits. Promote a virtuous cycle of cultural heritage protection and industrial development through a tripartite model combining culture, technology, and finance.

5.6. Accelerate Interdisciplinary Talent Development and Establish Flexible Recruitment Mechanisms

First, strengthen local talent cultivation. Foster partnerships with universities and training institutions to launch courses and certification programs in cultural heritage preservation and digitization. Encourage local institutions to collaborate with tech firms on dual-skill training programs such as “Artifacts + AI” or “Architecture + VR”. These efforts will help build a workforce equipped for industry needs and sustainable development. Introduce regionally coordinated digital heritage courses to ensure balanced growth and human capital for future projects.

Second, innovate flexible recruitment mechanisms. Establish a Lin Zexu heritage digitization workstation to host short-term residencies for experts from leading institutions like the Dunhuang Academy and the Palace Museum. Recruit remote collaborators, including historians and digital specialists, to contribute to revitalization efforts. Remove geographical and urban-rural barriers in talent mobility, attracting top domestic and international professionals to participate in Lin Zexu’s heritage projects. Create a shared expert resource platform to promote interregional and cross-sector collaboration.

6. CONCLUSION

The revitalization of Lin Zexu’s cultural heritage in the digital era represents both a profound historical responsibility and an urgent contemporary challenge. As a symbol of patriotism, integrity, and global vision, Lin Zexu’s legacy holds immense value for national cultural identity, civic education, and international dialogue. However, limitations in spatial capacity, narrative depth, technological integration, audience engagement, and sustainable operations continue to constrain the full realization of that value.

Digital technology offers powerful tools to address these challenges. Through immersive storytelling, intelligent interpretation, cross-platform dissemination, and data-driven management, digital solutions enable the creative transformation and innovative development of cultural heritage. By bridging time and space, technology not only preserves and disseminates historical memory but also facilitates emotional resonance and value co-creation among contemporary audiences.

This study has proposed a multi-dimensional revitalization framework grounded in the 4T model (Technology, Targeted, Talent, Transcendent), emphasizing the need for spiritual decoding systems, adaptive technical strategies, comprehensive data platforms, participatory mechanisms, sustainable funding models, and cross-disciplinary talent cultivation. These strategies aim to transform Lin Zexu’s cultural heritage into a dynamic, accessible, and meaningful cultural resource for the digital age.

Ultimately, the case of Lin Zexu offers broader insights for the digital revitalization of cultural heritage associated with historical figures across China and beyond. By aligning cultural preservation with technological innovation, cities and institutions can not only safeguard the legacy of the past but also inspire the values and imaginations of the future.

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CONFLICT STATEMENT

The authors declare no conflict of interest.

COOPERATION STATEMENT

All authors contributed equally to this work and approved the final manuscript.

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