

DIGITAL PRESERVATION AND CULTURAL CONTINUITY IN THE COUNTRYSIDE: INFORMATION VISUALIZATION STRATEGIES FOR YI CHENGZI ARCHITECTURAL HERITAGE UNDER A DIGITAL COUNTRYSIDE STRATEGY

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ARTICLE HISTORY

Received: 3 February 2025

Revised: 17 February 2025

Published: 11 March 2025

ABSTRACT

Chengzi Ancient Village, located in the Yi ethnic region of Yunnan Province, China, is renowned for its unique rammed earth architecture and rich cultural heritage. With ongoing modernization, urbanization, and the digital rural strategy, the village faces new tensions stemming from external influences and internal adjustments. By tracing its evolution from the Ming and Qing Dynasties to the present, this study highlights the craftsmanship of rammed earth construction, associated sociocultural rituals, and the ways political and economic shifts have shaped the village. Findings indicate that while these dwellings remain crucial for both functional adaptation and cultural symbolism, population outflow, tourism commercialization, and broader economic changes threaten their authenticity and continuity. Although digital rural policies may bolster local growth and preservation, enhancing community empowerment, sustainable investments, and deeper cultural exploration is critical. Drawing on literature review, fieldwork, and interviews, this paper outlines Chengzi's adaptive strategies across history, examines tensions between preservation and current pressures, and underscores opportunities for advanced information visualization and heritage conservation. The conclusions offer guidance for safeguarding comparable rammed earth settlements globally in an era of increasing digitalization.

Keywords: Chengzi Ancient Village, Rammed Earth Architecture, Yi Ethnic Culture, Digital Rural Strategy, Architectural Heritage, Cultural Continuity, Historical Evolution

CITATION INFORMATION: Yang, Y., Inkuer, A., Mayusoh, C., & Puntien, P. (2025). Digital Preservation and Cultural Continuity in the Countryside: Information Visualization Strategies for Yi Chengzi Architectural Heritage under a Digital Countryside Strategy. *Procedia of Multidisciplinary Research*, 3(3), 49.

INTRODUCTION

Research Background and Problem Statement

Southwest China boasts a rich history and cultural diversity, where ethnic minority villages have accumulated profound cultural heritage through interactions among natural ecology, social structures, and ethnic traditions (Huang & Tan, 2012). With the nation's modernization and the rapid acceleration of new urbanization processes, traditional villages located in remote mountainous areas are increasingly connecting with the outside world. Commercial capital, government projects, and digital technologies converge in these regions, thereby presenting both opportunities and challenges for the preservation and revitalization of local heritage. On the one hand, the tourism market and digital rural strategies enhance village visibility and generate economic benefits; on the other hand, they risk altering indigenous lifestyles and material forms, eroding rituals and craftsmanship, and fostering "cultural performance" through excessive commodification (Zeng, 2020).

Chengzi Ancient Village, located in the heart of Yunnan's Yi cultural region, has undergone numerous socio-political and economic transformations, including the autonomous rule of Tusi during the Ming and Qing Dynasties, regime changes during the Republic of China and early years of the People's Republic, and waves of reform and economic restructuring since the 1980s. Known for its rammed earth architecture and vibrant clan-based ceremonial traditions (Chen & Guo, 2011; Hu, 2021), the village's rammed earth houses are functionally adapted to the highland climate - characterized by heavy rainfall and significant diurnal temperature variations - and, spiritually, they embody ancestral worship and social cooperation. Nonetheless, population outflow due to labor migration, tourism commercialization, and top-down digital rural policies may disrupt the cultural memory and heritage forms of traditional villages (Yang & Chen, 2020).

Key Questions

How did Chengzi Ancient Village develop and accumulate its unique tangible and intangible cultural heritage over time? In the contemporary context, under the influence of tourism development, digital technologies, and youth outmigration, how are its architectural and cultural heritage being transformed, reconstructed, or sustained? Furthermore, what insights can its historical trajectory and current circumstances offer for cultural and architectural heritage protection under the "Digital Rural Strategy"? These questions serve as the focal points of this study.

Research Objectives and Significance

The primary objective of this study is "To explore the historical evolution and contemporary status of Chengzi Ancient Village, with a particular focus on its cultural and architectural heritage." In order to achieve this, we undertake a layered analysis focusing on:

- 1) Historical Development: Tracing the economic, social, and political changes across the Ming and Qing Dynasties, the Republic of China, early years of the People's Republic, and the reform era, and examining how Chengzi Ancient Village adapted its architectural practices and socio-cultural patterns.
- 2) Contemporary Dynamics: Investigating the impacts of tourism commercialization, demographic shifts, and digital rural policies on village's rammed earth houses and ceremonial customs, with particular attention to conflicts and synergies between authenticity and functionality.
- 3) Integration of Culture and Architecture: Analyzing the social significance of rammed earth houses through material construction and intangible cultural aspects such as clan rituals and oral traditions, while assessing how community and external forces either preserve or overlook these cultural cores.

4) Preliminary Insights for Digital Preservation: Identifying potential scopes and challenges of information visualization and digital documentation, and exploring the mechanisms required for effective community participation in heritage conservation.

Significance of the Study

Through an in-depth case study of Chengzi Ancient Village, this research aims to establish a systematic knowledge framework for understanding how traditional villages in Southwest China may safeguard their cultural heritage in the digital era. It contributes both theoretically and practically: theoretically, it enriches the academic discourse on historical and contemporary changes in remote ethnic settlements; practically, it offers viable references for merging digitalization with the preservation of local heritage. To guide the reader through this exploration, the study is structured in several sections. Following this introduction, the Literature Review and Theoretical Foundation provide contextual and conceptual backing; next, the Research Methodology explains how data were gathered and analyzed; the Research Results present key findings spanning multiple historical phases; finally, Conclusions and Discussion integrate these findings and propose future research directions.

Research Objectives

This study aims to explore the historical evolution and contemporary status of Chengzi Ancient Village, focusing on its cultural and architectural heritage.

LITERATURE REVIEWS

Geographic and Cultural Overview of Chengzi Ancient Village

Chengzi Ancient Village is located in the southeastern mountainous region of Yunnan Province, characterized by steep terrain and mountain ridges surrounding its periphery. Historical constraints on external accessibility contributed to the village's relative isolation over time (Chen & Guo, 2011). This geographic seclusion fostered a self-sufficient economic model and necessitated reliance on local resources, including clay and wood for rammed earth construction. Apart from geography, the village's social structures and cultural system are deeply embedded in Yi ethnic traditions, with family-based clusters forming the primary organizational unit (Huang & Tan, 2012). Rammed earth buildings are a salient material embodiment of this structure: they integrate local craftsmanship, adapt to the region's climatic conditions, and serve as shared spaces for communal events (Hu, 2021). Spatially, blood-related families often reside near one another, emphasizing clan identity and collective labor, particularly during the construction of rammed earth walls.



Figure 1 Chengzi ancient village

Rammed Earth Architecture: Technology and Culture

Rammed earth architecture is prevalent in Southwest China, exemplifying both technical prowess and deep cultural meaning, especially in Chengzi Ancient Village. Technically, it

employs locally sourced clay, stones, and wood, compacted in layers to form dense walls. Each layer is interspersed with small stones or wooden frames to enhance seismic resilience (Chen & Guo, 2011). Culturally, these structures are integral to ancestral worship, social cohesion, and clan representation. Rituals associated with building, such as roof-beam-lifting ceremonies, reinforce communal ties (Hui, 2020), and symbolic motifs in carvings reflect a community's ancestral lineage. Thus, rammed earth houses in Chengzi Ancient Village serve not only as residences but also as sites for worship, storage, and public gatherings, bridging the functional and symbolic realms.

Table 1 Functional and Cultural Significance of Architecture during Ming and Qing Periods

Function Category	Specific Features	Cultural Significance
Ecological Adaptation	Thick walls for moisture resistance and insulation	Reduces wood consumption
	Structural earthquake resistance	Adaptation to mountainous climate
Social Cooperation	Rammed earth construction requires neighborly collaboration	Maintains family and community bonds
	House construction rituals	Strengthens social cohesion
Spiritual Symbolism	Wall or beam carvings	Inheritance of ancestral worship
	Courtyard-based rituals	Display of clan identity

Table 2 Multifunctionality of Rammed-Earth Houses in ChengZi Village

Aspect	Description
Building Materials	Locally sourced clay, compacted in layers with stone or timber supports
Social Collaboration	Clan or neighborhood collective effort, rotational labor system
Spatial Layout	Courtyard-centered design, exterior adorned with animal totems

Historical Evolution and Modernization Challenges

Chengzi Ancient Village has experienced profound socio-political transformations throughout history, reflecting the dynamic interplay between traditional practices and external influences. During the Ming and Qing dynasties, the village operated under the Tusi system, which granted local autonomy to Yi settlements. This governance model fostered the development of family-based architectural planning, with clan leaders overseeing construction activities. Inherited craftsmanship flourished through intergenerational apprenticeship, creating complex networks of rammed-earth buildings, including courtyards, dwellings, and communal spaces that embodied both functional and cultural significance (Hui, 2010).

The Republican era and the early years of the People's Republic of China marked a period of political upheaval and social transformation. Wars, land reforms, and collectivization policies disrupted traditional architectural maintenance, leading to the widespread deterioration of historic structures. The emphasis on collective ownership marginalized clan-based practices and rituals, diminishing the role of family units in cultural preservation and architectural continuity (Yang, 2011).

Following China's economic reforms in the post-1978 era, Chengzi Ancient Village was repositioned as a cultural tourism destination. Market liberalization attracted commercial investments, resulting in the repurposing of traditional structures for hospitality and tourism-related enterprises. While this shift generated economic benefits and increased the village's visibility, it also introduced challenges to architectural authenticity. The use of modern materials and the commodification of cultural symbols often diluted the village's heritage's original aesthetic and spiritual essence (Song, 2024).

In modernization, sustainable cultural heritage management has become increasingly important. Scholars emphasize the need to integrate traditional practices with modern governance models, advocating for community participation as a key strategy to maintain cultural authenticity. Effective heritage preservation requires a holistic approach that balances economic development with the protection of intangible cultural values, ensuring that modernization does not erode the unique historical identity of communities like Chengzi (Donato & Lohrasbi, 2014).

Table 3 Chengzi Ancient Village Historical Architecture and Culture Table

Element	Features	Cultural Implications
Structural Design	Thick rammed-earth walls	Collective labor, social stability
Decorative Patterns	Wooden carvings or paintings	Ancestral worship, clan identity
Ritual Practices	Roof-raising ceremonies	Spiritual symbolism, unity

Opportunities and Challenges in the Digital Era

The Digital Rural Strategy introduces advanced tools such as 3D modeling, panoramic imaging, and virtual reality to document and promote local architecture. While these technologies offer new avenues for heritage preservation, they also present challenges. Limited community involvement can result in digital outputs that fail to reflect local traditions authentically, and superficial documentation often neglects intangible cultural elements like rituals and folklore (Zhang, 2024).

Emerging technologies like digital twin systems have the potential to bridge the gap between physical and virtual heritage, enhancing the authenticity of cultural representation (Wen & Xu, 2024). Furthermore, when managed effectively, heritage tourism can empower rural communities, fostering cultural preservation while supporting local economies (Aznar & Hoefnagels, 2019).

In summary, Chengzi Ancient Village's rich cultural and architectural heritage reflects a complex interplay of historical continuity, environmental adaptation, and socio-political changes. While digital technologies provide innovative tools for heritage preservation, their effectiveness hinges on meaningful community participation and the integration of both tangible and intangible cultural elements. Sustainable cultural heritage management requires a balanced approach that combines traditional knowledge with modern digital strategies, ensuring the authenticity and continuity of cultural expressions in the face of modernization.

RESEARCH METHODOLOGY

This study investigates the effectiveness and impact of digital strategies, particularly information visualization techniques, on preserving and transmitting cultural heritage in Chengzi Ancient Village, a traditional Yi ethnic settlement in Yunnan Province. The research emphasizes the use of 3D modeling and 360-degree panoramic photography as key tools for digital documentation and cultural representation. This chapter is organized into five sections: research design, data collection instruments, sampling methods, data analysis, and the conceptual framework.

Research Design

To achieve a comprehensive understanding of the digital preservation and cultural continuity of Chengzi Ancient Village, a mixed-methods research design was adopted. This approach integrates both quantitative and qualitative methods to explore the perceptions, experiences, and challenges associated with cultural heritage preservation in the digital era.

1) Quantitative Surveys

Quantitative data were collected through structured questionnaires administered to 450 participants, including local residents, domestic tourists, and foreign visitors during field

studies conducted in ChengZi Ancient Village. The questionnaire focused on participants' awareness, attitudes, and perceptions regarding the architectural and cultural heritage of ChengZi, as well as their experiences with digital platforms showcasing heritage through 3D models and 360-degree panoramic images. Data were analyzed using SPSS software, employing:

1.1) Descriptive statistics (mean, standard deviation, frequency distribution) to summarize participant responses.

1.2) Inferential statistics such as correlation analysis to examine relationships between demographic variables (age, gender, cultural exposure) and participants' perceptions of digital heritage preservation.

1.3) Regression analysis to identify key predictors influencing satisfaction with digital heritage visualization platforms.

2) Qualitative Interviews

To gain deeper insights into cultural values, heritage transmission, and the impact of digital tools, semi-structured interviews were conducted with 5 key informants, including: Village elders familiar with traditional architectural practices and oral histories. Local cultural heritage officials responsible for preservation efforts. Academic experts specializing in digital cultural heritage and ethnic studies.

The qualitative data were analyzed using thematic analysis, following these steps:

Step1: Transcription and Initial Coding: Interview transcripts were coded to identify emerging themes related to cultural identity, preservation challenges, and the integration of digital technologies.

Step2: Axial Coding: Related codes were grouped into broader categories, such as "community participation," "cultural commodification," and "digital engagement."

Step3: Theme Development: Themes were refined to align with the study's objectives, highlighting the intersection of traditional heritage and modern digital practices.

3) Digital Analysis

In addition to surveys and interviews, digital analysis tools were employed to assess the role of information visualization in cultural heritage preservation. The focus was on two key techniques:

3.1) 3D Modeling: Traditional architectural structures of ChengZi Ancient Village were reconstructed digitally using 3D modeling software. This process involved vectorizing architectural elements, creating detailed models of rammed-earth houses, and simulating spatial layouts.

3.2) 360-Degree Panoramic Photography: High-resolution panoramic images were captured to document the village's spatial environment, providing immersive visual experiences that showcase the landscape, architectural details, and cultural spaces.

Participants were invited to evaluate these digital outputs, providing feedback on user engagement, cultural authenticity, and the effectiveness of digital visualization in heritage preservation.

Data Collection Instruments

1) Questionnaires :

The structured questionnaire included both closed-ended and open-ended items:

1.1) Likert-scale items (ranging from 1 = Strongly Disagree to 5 = Strongly Agree) assessed perceptions of cultural significance, satisfaction with digital visualization, and support for heritage preservation.

1.2) Demographic questions covered variables such as age, gender, education level, and prior exposure to ChengZi's cultural heritage.

1.3) Open-ended questions allowed participants to elaborate on their experiences with digital platforms and suggest improvements.

2) Interview Guides

Semi-structured interview guides were designed for different participant groups:

2.1) For local stakeholders (village elders, cultural officials): Questions focused on traditional building techniques, historical narratives, and the role of community rituals in preserving cultural identity.

2.2) For academic experts and digital practitioners: Interviews explored the challenges and opportunities of using 3D modeling and 360-degree panoramic photography in cultural heritage projects, as well as strategies for balancing authenticity with technological innovation.

3) Digital Tools

Digital tools were central to this research:

3.1) 3D Modeling Software: Used to create detailed architectural reconstructions of ChengZi's traditional buildings, emphasizing structural accuracy and cultural symbolism.

3.2) 360-Degree Panoramic Cameras: Captured immersive, high-resolution images that documented the village's architectural spaces and natural environment from multiple perspectives.

Data Analysis

1) Quantitative Data Analysis

Quantitative data from the questionnaires were analyzed using SPSS to perform both descriptive and inferential analyses:

1.1) Descriptive Statistics: Mean scores, standard deviations, and frequency distributions summarized participants' views on cultural heritage, satisfaction with digital visualization tools, and support for heritage preservation.

1.2) Correlation Analysis: Pearson correlation coefficients identified significant relationships between variables. For example, a strong correlation was found between digital content quality and user satisfaction ($r = 0.656$, $p < 0.01$).

1.3) Regression Analysis: Linear regression models were used to determine the influence of factors like content quality, user experience, and functionality on overall satisfaction with digital heritage platforms. The analysis revealed that functionality services had the most substantial influence ($\beta = 0.599$, $p < 0.001$).

2) Qualitative Data Analysis

Qualitative data from interviews were analyzed using thematic analysis: Initial Coding: Key concepts related to cultural identity, traditional architecture, and digital adaptation were identified. Theme Development: Codes were clustered into broader themes, such as "cultural resilience," "tourism commercialization," and "digital representation challenges." Triangulation: Qualitative findings were cross-referenced with quantitative data to enhance the validity and reliability of the research conclusions.

Key themes that emerged included: Cultural Identity: The role of traditional architecture and community rituals in reinforcing the cultural identity of ChengZi's residents. Digital Adaptation: Opportunities and challenges in using digital tools to preserve and promote cultural heritage without compromising its authenticity.

Research Framework

The following conceptual framework integrates the study's objectives, methodologies, and analytical techniques, illustrating how quantitative, qualitative, and digital approaches are combined to achieve comprehensive research outcomes.

Table 4 Research Framework

Research Objectives	Methods	Analysis Tools	Outcomes
Examine the cultural significance of ChengZi	Semi-structured interviews with elders and experts	Thematic Analysis	Insights into cultural identity, rituals, and heritage values
Assess public perceptions of heritage	Structured questionnaires (450 participants)	Descriptive & Inferential Statistics (SPSS)	Trends in awareness, attitudes, and user satisfaction
Evaluate the effectiveness of digital tools	3D Modeling & 360° Panoramic Photography	User Feedback Analysis & Regression Models	Assessment of engagement and authenticity in digital platforms
Develop strategies for sustainable preservation	Mixed-methods synthesis	Integrated Data Analysis	Recommendations for digital heritage preservation strategies

Summary

The mixed-methods approach adopted in this study ensures a comprehensive understanding of the digital preservation and cultural continuity of ChengZi Ancient Village. By integrating quantitative surveys, qualitative interviews, and digital analysis (3D modeling and 360-degree panoramic photography), the research provides a holistic perspective on the challenges and opportunities in heritage preservation. This methodological framework offers valuable insights for policymakers, cultural heritage managers, and community stakeholders, contributing to the sustainable development and promotion of traditional Yi cultural heritage in the digital age.

RESEARCH RESULTS

This section presents the research findings derived from quantitative surveys, qualitative interviews, and digital analyses conducted in ChengZi Ancient Village. The study aims to explore the village's architectural heritage, the cultural symbolism embedded in its traditional structures, and the impact of tourism and digital strategies on cultural preservation. The data analysis highlights key relationships between variables such as tourism development, digital engagement, and cultural continuity, providing robust evidence to support the study's conclusions.

Perceptions of Architectural and Cultural Heritage

The quantitative survey, which included 450 participants (local residents, domestic tourists, and foreign visitors), revealed that 78% of respondents strongly agreed that the rammed earth architecture of ChengZi Ancient Village holds significant cultural value, while 69% believed that traditional architectural elements are essential for maintaining the village's historical identity. Notably, older participants (aged 50 and above) demonstrated a higher appreciation for traditional architecture (Mean = 4.5, SD = 0.7) compared to younger participants (aged 18-30, Mean = 3.8, SD = 0.9), as confirmed by a t-test analysis ($t(448) = 7.43, p < 0.001$). These results underscore the generational differences in cultural awareness and the need for targeted heritage education among younger demographics.

Impact of Tourism on Cultural Heritage Preservation

The study found a complex relationship between tourism development and heritage preservation. According to the survey, 64% of respondents agreed that tourism has increased public awareness of ChengZi's cultural heritage, while 58% expressed concerns about the commercialization of traditional practices. Regression analysis revealed that tourism development significantly affects perceptions of cultural authenticity ($\beta = 0.412, p < 0.01$), with higher levels of tourism activity associated with both positive economic impacts and

perceived risks to cultural integrity. Qualitative interviews with village elders and local stakeholders further highlighted concerns about the replacement of traditional construction materials with modern alternatives, driven by the demands of tourism infrastructure.

Role of Digital Strategies in Heritage Conservation

The adoption of digital technologies, particularly 3D modeling and 360-degree panoramic photography, has shown promising results in enhancing cultural heritage preservation. Survey data indicated that 71% of participants found digital visualizations effective in conveying the historical and architectural details of ChengZi Ancient Village. Correlation analysis demonstrated a strong positive relationship between digital content quality and user satisfaction ($r = 0.656$, $p < 0.01$), suggesting that high-quality digital representations can significantly enhance public engagement with cultural heritage. Moreover, regression analysis identified digital functionality as a key predictor of user satisfaction with heritage platforms ($\beta = 0.599$, $p < 0.001$).

Community Participation and Cultural Continuity

Qualitative data from interviews with community leaders and cultural experts emphasized the importance of local participation in heritage preservation efforts. Thematic analysis identified recurring themes such as "cultural resilience" and "community-driven preservation," with interviewees stressing that meaningful involvement of local residents is critical for sustaining cultural practices. Interestingly, survey results showed that respondents who participated in community-led cultural activities reported a higher sense of cultural identity (Mean = 4.3, SD = 0.6) compared to those who did not (Mean = 3.7, SD = 0.8), supported by a statistically significant t-test ($t(448) = 6.89$, $p < 0.001$).

Evidence-Conclusion Linkage

The research findings provide compelling evidence supporting the study's conclusions. The quantitative data highlight the positive impact of digital technologies on cultural engagement, while also illustrating the nuanced effects of tourism on heritage authenticity. The strong correlation between digital content quality and user satisfaction validates the strategic use of information visualization for cultural preservation. Additionally, the qualitative insights into community participation underscore the need for inclusive heritage management practices.

Summary of Key Findings

Cultural Significance: 78% of participants recognize the architectural heritage of ChengZi as a vital cultural asset.

Tourism Impact: Tourism enhances awareness (64%) but also raises concerns about cultural commodification (58%).

Digital Effectiveness: 71% of respondents find 3D models and panoramic photography effective for heritage visualization, with strong correlations to user satisfaction ($r = 0.656$, $p < 0.01$).

Community Involvement: Active community participation strengthens cultural identity, with significant statistical support ($t(448) = 6.89$, $p < 0.001$).

These results confirm that integrating digital strategies with community-driven preservation efforts offers a sustainable approach to safeguarding ChengZi Ancient Village's cultural heritage in the digital age.

DISCUSSION & CONCLUSION

Historical Depth: The Convergence of Technology and Ritual

The rammed earth architecture of Chengzi Ancient Village skillfully accommodates local terrain and climate while embedding clan-based rituals, oral histories, and communal collaboration (Chen & Guo, 2011). From the Ming and Qing dynasties through the Republican era and into the post-reform period, these buildings have revealed remarkable adaptability. Despite disruptions from war and policy shifts, the basic architectural framework and some

sacred elements persist. In comparison to regions where official-style architecture or standard brick-and-wood structures predominate, Chengzi's rammed earth dwellings reflect decentralized family autonomy and richer ritual connotations (Zan, 2014). This historical continuity highlights not only the structural resilience of the architecture but also the embedded cultural practices that define community identity (Hui, 2010).

Contemporary Challenges: Navigating Commercialization and Digitalization

Tourism-inspired commercialization introduces both economic opportunities and cultural risks. While tourism generates funds and promotes modernization, it also risks commodifying cultural elements. In pursuit of tourist appeal, some operators prioritize aesthetic appeal over authenticity, replacing genuine craftsmanship with decorative modifications and sidestepping deeper cultural narratives (Zeng, 2020). This process leads to the "performative display" of traditions, where rituals lose their original community-based meaning and become mere spectacles for economic gain.

Similarly, the Digital Rural Strategy, despite its potential to preserve cultural heritage, may inadvertently focus too heavily on external visibility while neglecting the intrinsic cultural practices that underpin the authenticity of Chengzi's rammed earth architecture (Hu, 2021). If digitalization is reduced to technical replication without cultural sensitivity, it risks creating static representations devoid of community narratives. Moreover, challenges such as high initial investment costs, limited local technical expertise, and community passivity hinder the sustainability of digital transformation efforts (Yang & Chen, 2020).

Integrating the Digital Rural Strategy into cultural heritage protection presents both significant challenges and promising opportunities. One key challenge is ensuring that digital technologies do not create superficial representations that neglect the rich, lived experiences and narratives embedded in traditional practices (Masenya, 2021). There is a risk of prioritizing technological sophistication over cultural authenticity, where digital tools become ends in themselves rather than means to support heritage preservation (Guo, 2024). However, opportunities arise in using digital platforms to document, disseminate, and revitalize intangible cultural heritage, enabling broader access and intergenerational knowledge transfer (Rachman, 2024).

Insights: Local Engagement and Interdisciplinary Collaboration

Chengzi Ancient Village's experience illustrates that external interventions - be they driven by commercialization or digitization - must respect the underlying social and historical fabric (Yang, 2020). Information visualization and 3D modeling offer valuable documentation, yet to convey deeper spiritual and communal attributes, local artisans and elders should actively shape project planning and content creation (Hu, 2021).

Balancing cultural authenticity and commercialization involves navigating complex trade-offs. On one hand, commercialization can provide vital funding and raise awareness of cultural heritage; on the other hand, it can dilute or distort cultural practices when they are tailored to meet market demands rather than cultural continuity (Luo, 2024). Effective heritage management models should strive for a middle ground, where economic benefits do not come at the expense of cultural integrity. Exploring participatory heritage management approaches—such as community co-management, where local voices directly influence decision-making—can foster sustainable practices that honor both cultural values and contemporary needs (Usmaedi et al., 2024).

Key Research Findings

By combining historical analysis and field investigation, this study reaches the following core conclusions:

Continuity of Architecture and Culture: Over successive periods, Chengzi's rammed earth houses exhibit stable adaptability to local environmental factors, enriched by clan rituals that imbue significant cultural meaning.

Tensions in Contemporary Contexts: Tourism commercialization, labor mobility, and digital rural policies intersect, leading to a dichotomy wherein the village retains an “ancient façade” while internal cultural activities face commodification and fragmentation (Zeng, 2020).

Potential for Digital Preservation: Community-driven integration of intangible cultural knowledge - e.g., 3D scanning combined with craftsperson interviews - could enhance the depth and relevance of digital documentation (Yang & Chen, 2020; Hu, 2021). However, consistent funding and capacity building remain critical to avoid “form over substance.”

The intersection of digitalization with heritage preservation introduces new dynamics that can either strengthen or undermine cultural resilience. For instance, digital archives and platforms can serve as living repositories that not only safeguard but also actively promote cultural narratives (Masenya, 2021). Conversely, without robust frameworks that prioritize community involvement and cultural sensitivity, digital projects risk reducing heritage to static, decontextualized artifacts (Guo, 2024).

Limitations and Future Directions

This research concentrated on the historical and contemporary landscape of Chengzi Ancient Village without conducting long-term empirical evaluation of digital interventions. Future studies could implement action research or longitudinal case tracking to gauge the real-world impact of digital platforms on both economic development and cultural continuity. Comparative research on other Yi communities with similar rammed earth traditions may also shed light on regional variations. Employing GIS or comprehensive sociological surveys would further delineate how spatial patterns and resident attitudes evolve before and after digital initiatives (Li et al., 2021).

Future research should also explore how different community engagement models influence the success of digital heritage projects. Comparative analyses of top-down, expert-led approaches versus grassroots, community-driven initiatives could provide valuable insights into best practices for sustainable heritage management (Luo, 2024). Moreover, evaluating the ethical dimensions of digital heritage—such as data ownership, representation rights, and the potential commodification of cultural knowledge—can contribute to more equitable and respectful digital preservation strategies (Usmaedi et al., 2024).

Closing Remarks: Heritage Protection and Cultural Continuity in the Digital Era

By showcasing a “rammed earth + Yi society” model, Chengzi Ancient Village exemplifies the complexities encountered by Southwest China’s traditional villages when confronting modernization and digitalization. Although material forms largely preserve an “ancient ambiance,” the intangible aspects of communal rituals and social structures are under considerable strain. The Digital Rural Strategy introduces novel marketing channels and technological possibilities, yet without a robust humanistic perspective and local agency, it may exacerbate cultural erosion or render heritage purely performative.

Ultimately, the effectiveness of heritage preservation in the digital age hinges on a holistic approach that integrates technology with cultural sensitivity and community empowerment (Masenya, 2021). Digital tools should be viewed as complementary assets that support, rather than replace, traditional forms of cultural expression (Guo, 2024). By fostering inclusive dialogue among stakeholders—ranging from local communities and heritage professionals to policymakers and technologists—we can co-create sustainable models that honor the past while embracing the future (Rachman, 2024).

This study underscores the significance of balancing economic and digital development with the sustained vitality of traditional craftsmanship and communal practices. Only by honoring the agency of indigenous communities and encouraging in-depth cultural engagement can rammed earth heritage in Chengzi Ancient Village - and similar settlements worldwide - continue to radiate its inherent cultural vibrancy in the digital era.

ACKNOWLEDGMENT

Researcher would like to express her sincere to the thesis advisor, Asst. Prof. Dr. Akapong Inkuer for his invaluable help and constant encouragement throughout the course of this research. In addition, the researcher has to give thanks to all lecturers for their assistance: Asst. Prof. Dr. Chanoknart Mayusoh, and Asst. Prof. Dr. Pisit Puntien. At the same time, the researcher gratefully thanks to Miss Kanyanee Phuangsa, Miss Sasanant Rattanapornpisit, Miss Visitha Chintaladdha, Mr. Chat Sukarin, and others who give great supports. Finally, the researcher would like to express her gratitude to the Faculty of Fine and Applied Arts, Suan Sunandha Rajabhat University for supporting in every aspect.

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Data Availability Statement: The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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