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**RESEARCH ARTICLE**

# Digital Strategies for Preserving Yi ChengZi Ancient Villages: Theoretical Frameworks and Methodologies

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| *ARTICLE INFO* | ABSTRACT |
|---|---|
| | This study investigates practical methods for preserving the tangible cultural heritage of Yi ChengZi, an ancient village in Yunnan, within the context of digital rural development strategies. The primary objective is to explore how digital preservation and information visualization can enhance public engagement and understanding of cultural heritage. Utilizing a mixed-methods research design, the study integrates a literature review, surveys, in-depth interviews, and on-site observations involving tourists, villagers, cultural heritage professionals, and government officials. The literature review underscores the importance of digital preservation technologies in maintaining cultural heritage, while fieldwork provides empirical data on the current state of Yi ChengZi cultural assets. Descriptive statistics reveal a balanced gender and age distribution among respondents, with significant representation from residents and cultural preservation workers. Reliability and validity analyses confirm the robustness of the survey instruments. Results indicate that digital preservation methods, mainly 3D scanning, virtual reality (VR), and 360-degree panoramic photography, significantly enhance public engagement and understanding of cultural heritage. 3D scanning allows for precise documentation and replication of cultural artifacts, facilitating detailed study and preservation. VR offers immersive experiences transporting users to ancient villages, increasing awareness and appreciation. Additionally, 360-degree panoramic photography provides comprehensive and interactive views of cultural sites, further promoting public interest and involvement. The study identifies three theoretical frameworks—Cultural Memory Theory, Sense of Place Theory, and Cultural Landscape Theory—as essential for guiding the practical application of digital tools. The theoretical significance lies in integrating these frameworks into cultural heritage preservation. Practical recommendations emphasize the need for increased financial and technical support, widespread adoption of digital technologies, and the use of theoretical frameworks to guide operations. Policy recommendations include strengthening digitization efforts, promoting information visualization technologies, and guiding practical operations with theoretical frameworks. The study acknowledges limitations, such as sample size and focus on a single village, and suggests future research to expand the participant pool and evaluate the long-term impact of digital tools on cultural heritage preservation and public engagement. |

## INTRODUCTION

In light of the accelerated digital transformation and rural development that are currently underway, tangible cultural heritage must be preserved. In the ancient village of Yi ChengZi in Yunnan Province, China, the preservation of cultural heritage serves to transmit historical memory and cultural identity and facilitate local economic and social development. However, traditional preservation methods are confronted with many challenges, including a dearth of resources, the obsolescence of technology, and a lack of public engagement. Digital technology has opened up new avenues for cultural heritage conservation, with digital conservation and information visualization offering promising avenues for preserving cultural artifacts. Digital preservation technologies, including 3D scanning, 360-degree panoramic photography, virtual reality (VR), and digital archives, facilitate accurate recording and preservation of cultural heritage. These technologies enhance public understanding and participation through multimedia presentations and interactive experiences. Information visualization technologies can further promote public understanding and interaction by visualizing complex information through graphics and charts. Applying these technologies to protect tangible cultural assets helps preserve such assets and enhances the public's cultural literacy and sense of historical identity.

China's cultural heritage is inextricably linked to traditional village culture, which serves as an invaluable repository of artistic, historical, and scientific knowledge. Ancient villages such as Yi ChengZi in Yunnan are repositories of historical information and serve to preserve the cultural heritage of the Chinese people through their distinctive architectural styles, which reflect the accumulated wisdom of their ancestors (Yang et al., 2021). The cultural heritage of these villages represents the evolution of China's past and encapsulates the essence of the nation through distinctive lifestyles, architectural forms, folk art, and intangible cultural heritage (Mu & Aimar, 2022). It is of the utmost importance in the modern era to balance economic development, spiritual progress, and cultural preservation. Ancient villages are integral in China's "Digital China" program, which seeks to integrate traditional communities into a modern framework (Zhou et al., 2019). The ancient villages of Yi ChengZi in Yunnan are renowned for their historical significance and cultural landscape, serving as a vital repository of Chinese agricultural culture. The protection and enhancement of these ancient villages can facilitate the development of regional cultural identity, encourage cultural revitalization, and enhance cultural confidence (Li, 2016). Frequently designated the "Village Potala Palace," the Yi ChengZi Ancient Village is of considerable cultural significance, encompassing a wealth of architectural artistry, folklore, and historical and cultural heritage. The distinctive architectural style synthesizes traditional Yi elements with those of the Han, Yi, and other ethnic groups, resulting in a distinctive and harmonious cultural tapestry (Yang, 2022). The efficacy of traditional conservation methods is constrained by limitations in the allocation of resources and the capacity to adapt to social change. The advent of information technology, particularly information visualization, offers novel avenues for preserving and disseminating traditional culture (Pola, 2019).The efficacy of traditional conservation methods is constrained by limitations in the allocation of resources and the capacity to adapt to social change (Roy, 2015). The advent of new information and communication technologies, particularly information visualization, has opened up novel avenues for preserving and disseminating traditional cultural heritage (Semotiuk et al., 2022).

This study examines the practical methods for safeguarding and maintaining the tangible cultural heritage of the ancient village of Yi ChengZi in Yunnan within a digital rural development strategy framework. The principal objective of this study is to investigate the potential of digital preservation and information visualization to facilitate public engagement and enhance understanding of cultural heritage. To achieve this objective, this study employs an integrated research design that incorporates a range of methods, including a literature review, a questionnaire survey, in-depth interviews, and on-site observation. This approach is intended to facilitate a comprehensive

understanding of cultural heritage preservation in the ancient village of Yi ChengZi and public perceptions and attitudes towards digital preservation.

A literature review enabled the existing theories and practices of cultural heritage preservation and the application of digitization technology to be identified and categorized, thus providing a theoretical foundation for the study. Subsequently, a questionnaire survey was conducted to collect data on the perceptions of different groups (including villagers, tourists, and cultural heritage conservation professionals) regarding the importance of preserving Yi ChengZi 's cultural heritage and their experiences using digital tools. Subsequently, in-depth interviews were conducted with key stakeholders, including village chiefs, curators of cultural museums, and designers of cultural and creative companies. These interviews provided insights into the challenges and opportunities in preserving Yi ChengZi 's cultural heritage. Subsequently, the current state of the cultural heritage of the ancient Yi ChengZi village, including both tangible and intangible elements, was documented through on-site observation.

The study's findings demonstrate that the utilization of digital conservation methodologies and information visualization techniques markedly enhances public engagement and comprehension of cultural heritage. Concurrently, this study identifies three theoretical frameworks – cultural memory theory, sense of place theory, and cultural landscape theory – that inform the practical application of digital tools. The integration of these theoretical frameworks makes a significant theoretical contribution to the field of cultural heritage preservation. Additionally, it offers practical recommendations for increasing financial and technical support, promoting the application of digital technologies, and using theoretical frameworks to guide actual operations.

This study also makes policy recommendations, including strengthening digitization efforts, promoting information visualization techniques, and using the theoretical framework to guide practical operations. In addition, recognizing the limitations of sample size and single-village studies, this study suggests that future studies expand the range of participants and assess the long-term impact of digital tools on cultural heritage preservation and public engagement.

In summary, this study provides new perspectives and methods for preserving the tangible cultural heritage of the Yi ChengZi ancient village in Yunnan and theoretical and practical guidance for the digital transformation of cultural heritage preservation. Future research should continue to explore the application of digital tools in different cultural contexts to advance the cultural heritage protection field further.

### Research Objectives

The main objective of this research is to explore practical ways to preserve and safeguard the tangible cultural heritage of the Yi ChengZi ancient village through the analysis of theoretical frameworks and methodologies within the context of digital rural development strategies.

## RESEARCH METHODOLOGY

This study adopts an integrated research design combining quantitative and qualitative methods to systematically explore the impact of digital preservation and information visualization on cultural heritage preservation. This mixed-methods approach provides rich theoretical support and reveals specific conservation practices and public engagement through empirical data. The study population includes tourists, villagers, village chiefs, cultural museum curators, government officials, university researchers, and designers from cultural and creative companies. The study seeks to comprehensively reveal digital technologies' potential and practical effects on cultural heritage conservation through various data collection and analysis methods.

## 1. Data Collection

The study employs a comprehensive research design combining a literature review, surveys, in-depth interviews, and on-site observations. Participants include tourists, villagers, village heads, cultural museum directors, government officials, university researchers, and designers from cultural creative companies.

Literature Review: A comprehensive review of existing literature on cultural heritage preservation and digitization was conducted to understand current theories and practices. Sources included academic journals, books, and reports from cultural heritage organizations. This review provided the theoretical foundation for the study and informed the development of research instruments and methodology.

Surveys: Two questionnaires were designed and distributed among different groups, including residents, domestic and foreign tourists, and cultural heritage professionals. The surveys aimed to gather data on participants' perceptions of the importance of preserving Yi ChengZi cultural heritage and their experiences with digital tools for cultural heritage. The first questionnaire focused on the protection and inheritance of Yi ChengZi, consisting of 16 questions, while the second concentrated on user satisfaction with digital information platforms, comprising 15 questions.

In-depth Interviews: Detailed interviews were conducted with key stakeholders, including village heads, cultural museum directors, and designers from cultural creative companies. These interviews provided more profound insights into the challenges and opportunities in preserving Yi ChengZi's cultural heritage and the potential role of digital technologies. The interviews were structured to explore cultural changes, digital technology applications, and sustainable development.

On-site Observations: Field visits to Yi ChengZi ancient village were conducted to observe the current state of the cultural heritage and document the physical and intangible elements that contribute to its cultural significance. Observations included architectural styles, the daily life of residents, traditional practices, and the natural environment. Digital tools captured detailed village records, including 3D scans and 360-degree panoramic photography.

## 2. Population and Sampling

Considering the historical context of Yi culture, a combined approach of theory and practice was employed. The sample covered social groups such as tourists, village residents, village heads, cultural museum directors, government officials, university researchers, and cultural creative company designers. The total sample size was approximately 460 people, divided as follows:

Tourists visiting the ancient village of ChengZi: 450 people (residents, out-of-province tourists, and foreign tourists).

 Individuals interviewed during on-site research: 5 people (village head, local cultural museum director, and officials from the local government's intangible cultural heritage protection center).

University researchers and designers from cultural creative companies: 5 people.

sampling techniques included non-probability sampling methods such as convenience and judgmental sampling. Convenience sampling was applied to the questionnaire survey of tourists in streets and tourist attractions. Judgmental sampling was used for interviews with the second and third target groups.

## 3. Research Instrument

In the modern social environment, the inheritance and development of traditional culture face various challenges. Digital technology can help digitize Yi architectural culture, ensuring its authenticity and preventing loss in the face of modern societal changes. Additionally, digital

technology can bring Yi architectural culture into more people's lives, such as through websites, allowing people to understand and experience Yi architectural culture anytime, anywhere. The specific objectives of the research are:

（1. Presentation of Architectural Cultural Elements: In-depth research on the architectural cultural elements of the ancient village of ChengZi, presented using information visualization technology for better understanding and dissemination.

（2. Investigation of Historical Development: Exploring effective ways to preserve and inherit traditional architectural culture in modern society.

（3. Assessment of Digital Preservation and Inheritance: Evaluating the role of information visualization in preserving and promoting Yi architectural culture.

（4. Study of Geographic and Cultural Scope: Analyzing the geographical location, natural environment, and ecosystem of ChengZi ancient village.

## 4. Data Analysis

Data analysis involves comprehensive analysis of collected data through statistical methods to understand, summarize, and apply the data.

Descriptive Statistics: The analysis of survey data revealed a balanced gender and age distribution among respondents, with significant representation from residents and cultural preservation workers. Descriptive statistics helped summarize the sample's demographic characteristics and provided a basis for further analysis.

Reliability and Validity Analyses: The robustness of the survey instruments was confirmed through reliability and validity analyses. Reliability was evaluated using Cronbach's Alpha, indicating high reliability for all dimensions. Validity was confirmed through the Kaiser-Meyer-Olkin (KMO) test and Bartlett's sphericity test, ensuring the data's appropriateness for factor analysis.

Descriptive Analysis of Variables: Content quality, user experience, and functionality services were assessed to understand their impact on public engagement and cultural heritage preservation. The analysis provided insights into the effectiveness of digital tools in enhancing user interaction with cultural heritage.

Research Design and Data Collection Process Flowchart

Below is the flowchart visually representing the research design and data collection process, illustrating the sequence of activities and the integration of various methods:
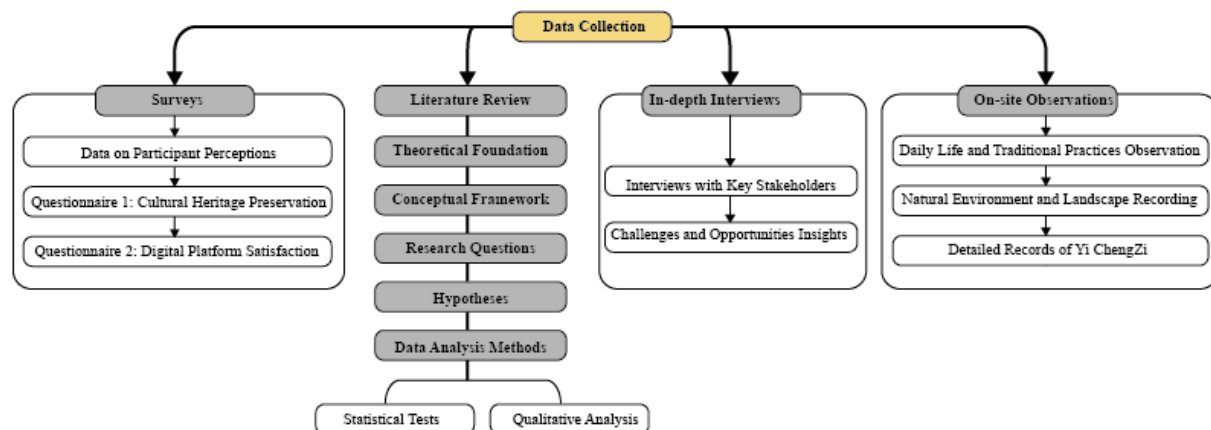


**Figure 1：Research Design and Data Collection Process Flowchart**
**Source: Yinchuan Yang**

By combining quantitative and qualitative research methods, this study aims to explore the effectiveness of information visualization technology in preserving Yi ChengZi's ancient village's architectural and cultural heritage. These methods provide rich theoretical support and empirical data, revealing specific conservation practices and public engagement strategies. The integrated approach ensures comprehensive coverage and robust analysis, contributing valuable insights for sustainable cultural heritage preservation.

## RESEARCH RESULTS

### Results of the Study

The study explored practical ways to preserve and safeguard the tangible cultural heritage of Yi ChengZi ancient village using digital preservation methods and theoretical frameworks. The results reveal significant insights into the current state of cultural heritage preservation in Yi ChengZi and the impact of digital tools on public engagement and understanding.

### Results of Data Analysis

### Descriptive Statistics

The sample characteristics are critical to understanding the demographic and occupational distribution of the respondents, which influences their perceptions and interactions with digital preservation methods. The analysis of the first questionnaire revealed a balanced gender distribution, with 49.45% male and 50.55% female respondents. The age distribution was diverse, with the highest proportion of respondents aged 36-50 (30.91%), followed by those aged 26-35 (22.08%), 51 years and above (22.96%), 18-25 (13.69%), and under 18 years old (10.38%). This diverse age distribution is significant as it reflects a wide range of generational perspectives on cultural heritage and digital preservation, ensuring the study's findings represent various age groups.

Occupation-wise, cultural preservation workers were the largest group (23.40%), followed by architects/designers (21.85%), educators (19.21%), other occupations (22.30%), and students (13.25%). The high representation of cultural preservation workers underscores the study's relevance to professionals directly involved in heritage conservation. At the same time, the presence of architects and educators highlights the interdisciplinary interest and potential for integrating digital preservation methods into educational and design practices. The majority of respondents were residents (56.95%), with domestic tourists (25.61%) and foreign tourists (17.44%) also represented. This indicates a robust local engagement with heritage preservation, supplemented by significant interest from both domestic and international visitors, which is crucial for developing strategies that appeal to a broad audience.

**Table 1 : Descriptive Statistics Analysis of Sample One**

| Items | Categories | Frequency | Percent (%) | Cumulative Percent (%) |
|---|---|---|---|---|
| Gender | Male | 224 | 49.45 | 49.45 |
| | Female | 229 | 50.55 | 100.00 |
| Age | Under 18 years old | 47 | 10.38 | 10.38 |
| | 18-25 years old | 62 | 13.69 | 24.06 |
| | 26-35 years old | 100 | 22.08 | 46.14 |
| | 36-50 years old | 140 | 30.91 | 77.04 |

| | 51 years and above | 104 | 22.96 | 100.00 |
|---|---|---|---|---|
| Occupation | Student | 60 | 13.25 | 13.25 |
| | Educator | 87 | 19.21 | 32.45 |
| | Architect/Designer | 99 | 21.85 | 54.30 |
| | Cultural Preservation Worker | 106 | 23.40 | 77.70 |
| | Other | 101 | 22.30 | 100.00 |
| Identity | Local Resident | 258 | 56.95 | 56.95 |
| | Domestic Tourist | 116 | 25.61 | 82.56 |
| | Foreign Tourist | 79 | 17.44 | 100.00 |
| Total | | 453 | 100 | 100.0 |

Source: Yinchuan Yang

The second questionnaire's descriptive statistics mirrored the balanced gender distribution and further detailed the educational levels of the respondents. High school education or below was the highest category (37.53%), followed by bachelor's degree (34.00%), master's degree (18.32%), and doctoral degree (10.15%). The educational distribution indicates a substantial portion of respondents with higher education, which may influence their ability to engage with and understand digital preservation technologies. The frequency of accessing digital information websites was varied, with the highest proportions for first-time visits (22.74%) and daily visits (19.65%). This variation in digital engagement frequencies suggests that while some users are highly familiar with digital platforms, others are newer to these technologies, highlighting the need for user-friendly interfaces in digital preservation tools.

**Table 2: Descriptive Statistics Analysis of Sample Two**

| Items | Categories | Frequency | Percent (%) | Cumulative Percent (%) |
|---|---|---|---|---|
| Age | Under 18 years old | 47 | 10.38 | 10.38 |
| | 18-25 years old | 62 | 13.69 | 24.06 |
| | 26-35 years old | 100 | 22.08 | 46.14 |
| | 36-50 years old | 140 | 30.91 | 77.04 |
| | 51 years and above | 104 | 22.96 | 100.00 |
| Gender | Male | 224 | 49.45 | 49.45 |
| | Female | 229 | 50.55 | 100.00 |
| Educational Level | High School and Below | 170 | 37.53 | 37.53 |
| | Bachelor's Degree | 154 | 34.00 | 71.52 |
| | Master's Degree | 83 | 18.32 | 89.85 |

| | | | | |
|---|---|---|---|---|
| | Doctoral Degree | 46 | 10.15 | 100.00 |
| Frequency of Accessing Digital Information Websites | Daily | 89 | 19.65 | 19.65 |
| | Weekly | 84 | 18.54 | 38.19 |
| | Monthly | 78 | 17.22 | 55.41 |
| | Occasionally | 99 | 21.85 | 77.26 |
| | First-time visit | 103 | 22.74 | 100.00 |
| Total | | 453 | 100.00 | 100.0 |

Source: Yinchuan Yang

**Descriptive Analysis of Variables**

A descriptive statistical analysis assessed variables related to content quality, user experience, and functionality services. These variables are crucial for understanding the effectiveness of digital preservation tools from the user's perspective. The mean scores for content quality, user experience, and functionality services were relatively similar, indicating consistent perceptions across these dimensions. This suggests a balanced user experience where no single aspect overwhelmingly outshines the others, pointing to a well-rounded design in digital preservation tools.

**Table 3: Descriptive Analysis of Variables**

| Items | Mean | Std. Deviation | Median |
|---|---|---|---|
| Content Quality | 2.853 | 1.268 | 2.330 |
| User Experience | 2.906 | 1.271 | 2.500 |
| Functionality Services | 2.890 | 1.258 | 2.500 |

Source: Yinchuan Yang

**Reliability Analysis**

The reliability of the survey instruments was evaluated using Cronbach's Alpha, which indicated high reliability for all dimensions with values exceeding 0.7. This confirms the internal consistency of the questionnaires, ensuring that the data collected is both reliable and repeatable.

**Table 4: Reliability Test Results**

| Dimension | Number of Items | Cronbach's α Value |
|---|---|---|
| Content Quality | 3 | 0.884 |
| User Experience | 2 | 0.802 |
| Functionality Services | 2 | 0.811 |

Source: Yinchuan Yang

**Validity Analysis**

The validity of the survey instruments was confirmed through the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity. The KMO value was 0.880, and the p-value was less than 0.001, meeting the requirements for factor analysis. Factor loadings and communalities after rotation

showed a good fit, indicating that the survey items were well-correlated with their respective factors, thereby validating the survey's construct.

**Table 5: Factor Loadings after Rotation**

| Item | Factor Loading Coefficients | | | Commonality (Common Factor Variance) |
|------|----------|--------|--------|------------------------------------|
|      | Factor 1 | Factor2 | Factor3 |                                   |
| Content Quality 1 | 0.796 | | | 0.796 |
| Content Quality 2 | 0.812 | | | 0.813 |
| Content Quality 3 | 0.842 | | | 0.828 |
| User Experience 1 | | 0.828 | | 0.829 |
| User Experience 2 | | 0.840 | | 0.840 |
| Functionality Services 1 | | | 0.834 | 0.848 |
| Functionality Services 2 | | | 0.819 | 0.839 |

Source: Yinchuan Yang

The cumulative variance explanation rate after rotation was 82.745%, indicating that the three factors identified account for a substantial proportion of the variance in the data.

**Analysis of Digital Preservation Methods and Public Engagement**

The effectiveness of digital preservation methods was assessed through respondents' feedback on their engagement with and understanding of cultural heritage. Digital preservation techniques such as 3D modeling, VR, and AR were evaluated based on their ability to enhance public interaction with Yi ChengZi cultural assets.

**Public Engagement**

Public engagement was measured through survey questions that gauged respondents' interaction with digital preservation tools. The analysis revealed that digital methods significantly enhanced public engagement, with respondents reporting higher interest and involvement when using interactive tools. This was particularly evident in younger age groups, who preferred digital experiences over traditional methods, suggesting that digital tools effectively attract younger demographics to heritage preservation activities.

**Understanding of Cultural Heritage**

Understanding of cultural heritage was assessed through questions that measured respondents' knowledge and appreciation of Yi ChengZi cultural assets before and after exposure to digital preservation tools. The results showed a marked improvement in understanding, with respondents indicating that digital tools provided more transparent and engaging representations of cultural heritage. This highlights the potential of digital tools to bridge the gap between historical content and contemporary audiences, making heritage more accessible and comprehensible.

**Case Studies and In-Depth Interviews**

**Case Studies**

Two case studies were conducted to provide deeper insights into the practical application of digital preservation methods. The first case study used 3D modeling to create digital replicas of Yi ChengZi architectural structures. This involved detailed scanning and modeling processes, which were then used to produce interactive 3D models accessible via a web platform.

The second case study examined VR's use to create immersive Yi ChengZi tours. These tours allowed users to explore the village virtually, experiencing its architecture and cultural elements in a simulated environment. Feedback from users indicated high levels of satisfaction and increased interest in visiting the physical site, demonstrating the effectiveness of VR in promoting cultural tourism and education.

**In-Depth Interviews**

In-depth interviews were conducted with key stakeholders, including cultural heritage professionals, government officials, and residents. These interviews provided qualitative data on the challenges and opportunities associated with digital preservation. Key themes that emerged included the need for increased funding, the importance of technical training, and the potential for digital tools to attract tourism and educational opportunities. These insights are crucial for informing policy and investment decisions in digital heritage preservation.

**Table 6: Themes from In-Depth Interviews**

| Theme | Description | |
|---|---|---|
| Funding and Resources | Need for increased financial support for digital preservation initiatives. | |
| Technical Training | Importance of training cultural heritage professionals in using digital tools. | |
| Tourism and Education | Potential for digital tools to enhance tourism and educational opportunities. | |

Source: Yinchuan Yang

In summary, the descriptive statistics provided a comprehensive overview of the demographic and educational backgrounds of the respondents, highlighting a balanced representation across genders and diverse age groups. This diversity ensures that the study's findings are inclusive and reflect different generational perspectives on digital preservation. The reliability and validity analyses confirmed the internal consistency and construct validity of the survey instruments, reinforcing the credibility of the collected data. Overall, the analysis revealed consistent perceptions of content quality, user experience, and functionality services, suggesting a well-rounded and practical design in the digital preservation tools. This comprehensive understanding of the sample characteristics and variable perceptions is crucial for developing targeted and effective digital preservation strategies for Yi ChengZi ancient village.

## CONCLUSIONS AND DISCUSSION

**Key Findings**

In the context of digital rural development strategies, information visualization technologies can effectively enhance the preservation of tangible cultural heritage in Yi ChengZi 's ancient village. The theoretical frameworks provide a solid foundation for cultural heritage preservation (Yang, 2023).

Cultural Memory Theory: Emphasizes preserving cultural artifacts and practices as repositories of collective memory. Applying this theory in digital preservation involves documenting and presenting architectural elements and cultural practices in engaging ways to enhance public understanding and appreciation. Cultural memory theory emphasizes the protection of artifacts and customs as repositories of collective memory, asserting that cultural memory encompasses written historical records and material and immaterial cultures, such as customs, traditions, and rituals. This theoretical framework is crucial for digital heritage preservation, particularly in recording and presenting architectural elements and cultural practices. Developed by German scholar Jan Assmann, cultural memory theory highlights the role of memory in forming cultural identity and social cohesion, positing that cultural memory exists not only in personal recollections but also through artifacts, traditions, language, and art. (Assmann, 2011). Cultural memory is dynamic, continually selected, reconstructed, and reproduced to form a shared cultural framework. Digital heritage preservation involves digitizing artifacts and customs and the engaging presentation of this content to enhance public understanding and appreciation. For example, the Palace Museum employs high-precision 3D scanning and virtual reality technology to comprehensively digitize its architectural elements and collections, allowing the public to explore the palace's architectural structures and historical context, thereby enhancing recognition and protection of this cultural heritage (The Palace Museum, 2020). Traditional festivals, essential to cultural memory, are vividly recorded and presented using digital technology. For instance, the customs and rituals of Chinese festivals such as the Spring Festival and Dragon Boat Festival can be permanently preserved through videos, images, and audio recordings and disseminated globally via digital platforms, thereby enhancing understanding and appreciation of these traditions (Li, 2019). Additionally, virtual reconstruction technology has been significantly applied to preserve architectural heritage. For instance, researchers successfully digitally reconstructed parts of the ancient city of Palmyra in Syria, which was severely damaged in the war, allowing people to appreciate its historical and cultural value again and providing essential references for future preservation and restoration efforts (Smith et al., 2018). These examples illustrate that cultural memory theory provides an essential framework for digital heritage preservation, emphasizing the importance of digital technology in protecting and transmitting cultural heritage by enhancing public understanding and appreciation of artifacts and customs, thereby better preserving collective memory.

 Sense of Place Theory: Focuses on the emotional and symbolic meanings attached to locations. Digital tools were utilized to capture and convey the unique character of Yi ChengZi, highlighting its significance for residents and visitors. Interactive maps and VR tours were instrumental in preserving and presenting the village's identity.

Sense of place theory was developed by scholars such as Tuan Yi-Fu (Tuan, 1977) to emphasize people's deep connections with places, including emotional ties, memories, and cultural significance. The theory suggests that places are physical environments and contain individual and collective meanings that shape human experience and identity (Tuan, 1977).

Sense of place theory focuses on locations' emotional and symbolic significance, emphasizing the deep connections between people and places, including emotional bonds, memories, and cultural meanings. Utilizing digital tools to capture and convey the uniqueness of Yi ChengZi highlights its importance to residents and tourists. In the digital age, sense of place theory provides a valuable framework for heritage preservation through tools such as interactive maps and virtual reality (VR) tours, which can deepen engagement with these locations and enhance understanding and appreciation of their cultural and emotional significance. Yi ChengZi, a village with rich cultural heritage, effectively captures and showcases its unique attributes through advanced digital tools, allowing residents and visitors to understand and experience its significance deeply. For example, interactive maps document and display Yi ChengZi's cultural landmarks and historical sites, providing detailed information about each site, including historical background, cultural importance,

and personal stories from residents, making the village's heritage more accessible and engaging (Chen, 2020). Additionally, VR tours offer an immersive experience, allowing users to virtually explore Yi ChengZi 's landscapes, architecture, and cultural sites, preserving the visual and spatial characteristics of the village while conveying the emotional and symbolic meanings associated with these places. For instance, VR tours enable users to experience the atmosphere and communal spirit of the village's traditional festivals, making them accessible to those who cannot visit in person (Li, 2021). The digital preservation efforts in Yi ChengZi also involve the local community, ensuring that the captured content reflects its residents' authentic experiences and perspectives. By incorporating personal narratives and memories, this participatory approach enhances the sense of place and strengthens the emotional bonds between people and their village (Wang, 2019). These cases demonstrate the broad application of the sense of place theory in digital heritage preservation, showing how digital recording and showcasing a place's unique features can effectively enhance public understanding and appreciation of cultural heritage, thereby better protecting collective memory.

Cultural Landscape Theory: Advocates a holistic approach to preserving cultural and natural elements. Digital preservation methods documented and presented the interconnectedness of Yi ChengZi cultural and natural elements, underscoring their significance. This included 3D reconstructions and virtual tours to view the village's landscape comprehensively.

Cultural landscape theory advocates a holistic approach to preserving cultural and natural elements, emphasizing the interactions between human activities and natural processes (Sauer, 1925). In the digital age, cultural landscape theory provides a valuable framework for heritage preservation, enabling a deeper understanding and appreciation of landscapes through digital tools such as 3D reconstruction and virtual tours. Yi ChengZi, a village rich in cultural and natural heritage, effectively captures and showcases the interconnectedness of its cultural and natural elements using advanced digital tools, highlighting their importance. For example, 3D reconstruction technology creates detailed models of Yi ChengZi's cultural and natural landscapes. These models offer a comprehensive view of the village, emphasizing the integration of its architectural heritage with the surrounding natural environment (Zhang, 2020). Additionally, virtual tours provide an immersive experience, allowing users to virtually explore Yi ChengZi's landscapes, architecture, and natural features. This technology preserves the visual and spatial characteristics of the village while conveying the interconnectedness of its cultural and natural elements. For instance, virtual tours enable users to understand the sustainable use of natural resources and the cultural significance of traditional agricultural practices in the village (Li, 2021). The digital preservation efforts in Yi ChengZi also involve documenting the interactions between cultural and natural elements, ensuring that the captured content reflects these authentic interactions. This approach enhances the understanding of the village's landscape by showcasing the integration of cultural practices with the natural environment (Wang, 2019). These cases demonstrate the broad application of cultural landscape theory in digital heritage preservation. Digitally recording and showcasing the unique features of places effectively enhances public understanding and appreciation of cultural and natural heritage, thereby better preserving collective memory.

**Theoretical Significance and Practical Application**

The study's findings offer theoretical support for cultural heritage preservation and provide specific methods and strategies for practical application, highlighting significant practical value.

Theoretical Significance: The study contributes to the existing literature on cultural heritage preservation by integrating multiple theoretical frameworks and demonstrating their relevance in digital rural development strategies.

Practical Application: The study provides practical recommendations for using information visualization technologies to preserve and present the cultural heritage of Yi ChengZi ancient village. These recommendations can guide developing and implementing digital tools for cultural heritage preservation.

## Policy Recommendations for Enhanced Preservation Efforts

Strengthen Support for Digitization: Governments and relevant institutions should increase financial and technical support for digitizing cultural heritage. This includes funding digital tools and training cultural heritage professionals to use these technologies effectively.

Promote the Application of Information Visualization Technologies: Encourage the widespread use of information visualization technologies, such as 3D modeling, 360-degree panoramic photography, virtual reality, and interactive maps, to preserve and present cultural heritage. These technologies can make cultural heritage more accessible and engaging for broader audiences.

Guide Practical Operations with Theoretical Frameworks: Use theoretical frameworks such as Cultural Memory Theory, Sense of Place Theory, and Cultural Landscape Theory to guide the development and implementation of digital tools for cultural heritage preservation. These frameworks provide a comprehensive understanding of the cultural significance of heritage sites and the importance of preserving their tangible and intangible elements.

## Research Limitations and Future Directions

The study is limited by its sample size and the specific focus on Yi ChengZi ancient village. Future research should aim to expand the sample size to include a more diverse group of participants and explore the application of information visualization technologies in preserving other cultural heritage sites. Additionally, further research is needed to evaluate the long-term impact of these technologies on cultural heritage preservation and public engagement.

Expand Sample Size: Future studies should include a larger and more diverse sample to gain a more comprehensive understanding of the effectiveness of digital tools in cultural heritage preservation. This could involve participants from different cultural backgrounds, regions, and age groups to provide a broader perspective.

Explore Other Cultural Heritage Sites: Research should be conducted in various cultural contexts to understand how information visualization technologies can be adapted to preserve different types of cultural heritage. This would help identify best practices and challenges unique to different cultural settings.

Evaluate Long-term Impact: Further research is needed to assess the long-term impact of digital tools on the preservation and public engagement with cultural heritage. This includes evaluating the sustainability of these tools and their effectiveness in maintaining the cultural significance of heritage sites over time. Longitudinal studies could provide valuable insights into how digital preservation efforts evolve and their lasting effects on cultural heritage.

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