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The Impact of Technological Applications on Consumer Satisfaction from the Perspective of Cultural Heritage Revitalization

Yue Zhang[1], Keni Chen[2], Tingting Jin[2], Chenxi Pan[2], Xiaoyun Zheng[2]*
1. School of Teacher Education, Quzhou University, Quzhou, Zhejiang 324000, China
2. School of Business, Quzhou University, Quzhou, Zhejiang 324000, China
***Corresponding Author, E-mail: 40026@qzc.edu.cn**

Abstract
With the rise of the "museum boom" and "intangible cultural heritage (ICH) boom," alongside the advancement of cultural heritage revitalization strategies, technologies such as digital media, new media, and virtual reality have become core tools for revitalizing rural cultural heritage. Meanwhile, consumer demand has shifted from basic sightseeing toward immersive cultural experiences. Drawing on the Stimulus–Organism–Response (S-O-R) theory, Self-Determination Theory, and Perceived Value Theory, this study constructs a theoretical framework of "technological application–cultural identity–consumer satisfaction." Using four villages, including Yancun in Quzhou, Zhejiang Province, as case sites, and analyzing 396 valid questionnaires, this study examines the internal mechanisms through which technological applications influence consumer satisfaction. The results indicate that: (1) technological application has a significant positive effect on consumer satisfaction, with cultural identity playing a fully mediating role; and (2) the mediating effects of different dimensions of cultural identity vary, with social value and competence needs exerting the strongest mediating effects, while relatedness needs show the weakest. This study clarifies the functional mechanisms of technological applications in cultural heritage revitalization and provides practical guidance for precise technology selection and experience design in the integration of rural culture and tourism, thereby contributing to rural revitalization.

Keywords
Cultural heritage revitalization; technological application; consumer satisfaction; cultural identity; S-O-R theory; rural culture–tourism integration

Introduction

At present, China is experiencing a flourishing "museum boom" and "intangible cultural heritage (ICH) boom," with public attention to and demand for cultural heritage rising significantly. The revitalization of cultural heritage has thus become not only an important means of meeting the public's cultural needs, but also a key undertaking in advancing the rejuvenation of Chinese culture. As a country rich in cultural heritage resources, China possesses a vast array of both tangible and intangible heritage. However, under the impact

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of globalization and modernization, traditional approaches to heritage development face challenges such as one-way information transmission and rigid forms of engagement. Coupled with the upgrading of consumer demand toward personalized, immersive experiences and cultural identification, conventional development models are increasingly inadequate. In this context, technological application has emerged as a critical opportunity for heritage revitalization.

The Third Plenary Session of the 20th Central Committee of the Communist Party of China proposed "exploring effective mechanisms for integrating culture and technology," and digital technologies such as virtual reality (VR) and augmented reality (AR) are gradually being introduced into rural areas, offering new pathways for rural heritage revitalization. However, existing studies have largely focused on technological implementation, with insufficient attention to how such applications influence consumer psychological perceptions and satisfaction, creating a potential disconnect between technological investment and user experience. The 14th Five-Year Plan for Cultural Relics Protection and Scientific and Technological Innovation clearly indicates that consumer demand has shifted from "basic sightseeing" to "in-depth experience" and "emotional resonance." The Ministry of Culture and Tourism has also identified "the effectiveness of technological application" and "consumer satisfaction" as core evaluation indicators. Despite increasing investment in technology across regions, how to effectively enhance consumer satisfaction through technological means and achieve a balance between "social benefits" and "market benefits" remains a question requiring systematic investigation.

Drawing on the Stimulus–Organism–Response (S-O-R) theory, Self-Determination Theory, Perceived Value Theory, and Tourist Satisfaction Theory, this study constructs a theoretical framework of "technological application–cultural identity–consumer satisfaction." It aims to examine the mechanisms through which technological applications affect consumer satisfaction, thereby providing theoretical support for optimizing technology selection and improving scenario-based applications. Ultimately, the study seeks to promote the integrated development of rural culture and tourism and contribute to the realization of rural revitalization through cultural empowerment.

1. Literature Review and Theoretical Foundations

1.1 Literature Review

1.1.1 Research on Technology-Enabled Cultural Heritage Revitalization

Scholars have extensively explored the specific mechanisms through which technology empowers cultural heritage revitalization, forming a relatively clear classification system of technological applications. These can be broadly categorized into three core types: new media technologies, digital technologies, and virtual reality technologies. Through tailored applications, these technologies facilitate the achievement of phased objectives in cultural heritage revitalization.

The first category is new media technologies, whose primary carriers include short videos, livestreaming, and integrated media platforms at various levels. These technologies are mainly aimed at expanding both the breadth and depth of cultural heritage dissemination. Wang Wen (2024), in the case of the traditional

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village of Chengkan in southern Anhui, utilized livestreaming of intangible cultural heritage production and lifestyle-oriented short videos to establish an interactive "communication–feedback" mechanism, effectively sustaining public engagement and broad audience reach [1]. To further overcome cognitive barriers, Zhao Ruifang et al. (2025) developed dialect-based digital ICH content through county-level integrated media platforms, addressing the high threshold of rural cultural understanding and enabling cultural communication to transcend limitations of age and geographic segmentation [2]. Together, these studies demonstrate that new media technologies not only enhance the social influence of cultural heritage but also lay a cognitive foundation for deeper cultural identification.

The second category is digital technologies, which focus on building foundational infrastructures and optimizing user experience. These include cultural relic databases, online exhibition halls, intelligent guide systems, and big data analytics, all of which aim to provide platforms that deepen users' cultural understanding. For instance, the Hunan Museum has established a digital database and online exhibition platform, breaking the physical constraints and access barriers of on-site visits and enabling "barrier-free" cultural accessibility, thereby laying the groundwork for deeper cognition. Further, Yin Fengjie (2023), in the context of Luodai Ancient Town, demonstrated that technologies such as AR-based object recognition and intelligent queuing systems effectively reduce users' information and time costs, thereby enhancing the efficiency of the visitor experience [3]. Zhu Ying (2025) proposed the "infrastructure–creation–transformation" model, which leverages big data analytics to accurately match user needs and promote the personalized optimization of cultural content supply, shifting cultural cognition from "broad coverage" to "precision deepening" [4].

The third category is virtual reality technologies, which focus on constructing immersive experiences and promoting the transition from cognitive understanding to emotional identification. Applications include VR-based scene reconstruction, AR/SLAM integration of virtual and real environments, as well as multi-sensory interaction and role-immersion design. Wei Yanyu (2022) used VR technology to reconstruct intangible cultural heritage practices of the Grand Canal, transforming user experience from passive observation to active perception [5]. Similarly, AR-based color restoration of artifacts at the Museum of the Terracotta Warriors and Horses of Qin Shihuang, as well as SLAM-based virtual-real integration at the Mawangdui Han Tomb, have further enriched the multidimensional presentation of cultural information and strengthened cognitive depth. Li Hui (2025), in research on "role-immersion" projects, confirmed that multi-sensory interaction and role-based engagement significantly enhance users' emotional resonance, ultimately transforming participants into "cultural identifiers" [6]. Chang Pan (2024), through the "cultural core–technological carrier–experience design" model, reached similar conclusions [7].

In summary, these three categories of technologies collectively form an enabling chain of "dissemination expansion → cognitive deepening → emotional identification," effectively addressing key challenges in traditional cultural heritage revitalization, such as limited outreach, weak experiential engagement, and low levels of identification. However, existing research still exhibits certain limitations. On the one hand, it has not quantitatively assessed the differential contributions of various technologies to distinct dimensions of cultural identity. On the other hand, it has not adequately resolved the imbalance observed in some contexts where "technology outweighs culture" (Zhang Qi et al., 2024) [8]. As a result, the practical value of technology-enabled solutions lacks precise academic support, making it difficult to establish replicable optimization

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pathways.

1.1.2 Research on Technological Applications and Consumer Perception

From the perspective of theoretical validation, Li Donghe and Wei Ming (2023), drawing on the Stimulus–Organism–Response (S-O-R) framework, confirmed a transmission pathway of "cultural perception → cultural identity → place identity → behavioral intention" [9]. Similarly, Zheng Yi et al. (2025), based on Perceived Value Theory, constructed a four-dimensional satisfaction evaluation system encompassing functional, environmental, emotional, and social dimensions [10]. While this framework can be extended to cultural heritage contexts, it does not explicitly specify the correspondence between technological applications and each value dimension, thereby limiting its ability to guide technology selection for the comprehensive enhancement of perceived value.

Regarding perceptual differences, the diversification of tourist needs calls for differentiated ("segmented") technological applications. Zhou Lin (2024) found that younger groups tend to prefer socially interactive features such as AR-based check-ins and short-video sharing, whereas middle-aged and older groups place greater emphasis on authenticity-oriented experiences, including digital guided interpretation and high-definition displays of cultural relics [11]. Extending this line of inquiry, levels of cultural cognition also influence perceptual preferences: individuals with higher levels of cultural knowledge tend to focus on the transmission of cultural meaning through technology, while those with lower levels prioritize convenience and ease of experience. However, existing studies have not sufficiently addressed how combinations of technologies can simultaneously accommodate these divergent needs, resulting in a lack of holistic improvement in overall satisfaction.

In summary, consumer perception serves as a crucial mediating link between "technological application" and "consumer satisfaction." Although prior research has validated the pathway of "perception → identity → behavioral intention" and begun to recognize the role of technology as an external stimulus, it has yet to clearly articulate the specific mechanism of "technological application → perceptual dimensions → satisfaction," particularly within the context of cultural heritage.

1.1.3 Literature Review Summary

A synthesis of the above studies reveals that the existing literature provides multifaceted support. First, research on cultural heritage revitalization highlights technology as a key driver of dynamic preservation and has preliminarily explored the alignment between different technologies and types of heritage, thereby providing a basis for categorizing technological applications into digital technologies, new media technologies, and virtual reality technologies. Second, studies on technological applications and consumer perception have validated the theoretical linkage of "perception–identity–satisfaction," offering a foundation for constructing a mediating model of "technology–cultural identity–satisfaction."

Nevertheless, two critical gaps remain in the current body of research and warrant further investigation.

(1) Mechanism Gap: Technology–Cultural Identity–Satisfaction

Although some studies suggest that technological applications can enhance cultural identity and satisfac-

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tion, they have not systematically verified the mediating role of cultural identity or examined the differential effects across its various dimensions.

(2) Methodological Gap: Limited Quantitative Analysis

Most existing studies rely on qualitative approaches or single-case analyses, lacking large-sample quantitative research. This limits the ability to accurately measure the magnitude of technological effects and to rigorously test the significance of mediating mechanisms.

To address these gaps, this study adopts the S-O-R framework, integrates Self-Determination Theory and Perceived Value Theory, and constructs a theoretical model of "technological application–cultural identity–consumer satisfaction." Through empirical analysis, it seeks to uncover the underlying mechanisms and provide a scientific basis for optimizing technology selection and enhancing consumer satisfaction in cultural heritage revitalization.

1.2 Theoretical Foundations

1.2.1 S-O-R Theory

The S-O-R theory originates from the behaviorist Stimulus–Response (S-R) framework and was further developed within cognitive psychology, eventually becoming a foundational theory in consumer behavior research [12]. Its core logic posits that external stimuli (Stimulus) trigger individuals' internal psychological processes (Organism), which in turn lead to behavioral responses (Response), thereby explaining the transmission mechanism of "external environment–internal psychology–behavioral output." In the field of consumer behavior, this theory emphasizes that consumption decisions involve a mediating process of "stimulus reception–psychological evaluation–behavioral choice."

In the context of tourism and cultural heritage, Li Donghe and Wei Ming (2023) demonstrate that stimuli such as cultural artifacts and environmental atmospheres perceived by tourists can influence their behavioral intentions through psychological mechanisms, particularly by activating cultural identity. This finding provides direct theoretical support for the present study.

Based on this framework, this study constructs the following analytical model: technological application is conceptualized as the external stimulus (S), encompassing three categories—digital technologies, new media technologies, and virtual reality technologies; cultural identity is treated as the organism (O), serving as a mediating variable with four dimensions: autonomy need, competence need, relatedness need, and social value; and consumer satisfaction is defined as the final behavioral response (R).

This framework aligns with the real-world transmission pathway of "technology empowerment–psychological perception–experience evaluation," and provides a solid theoretical foundation for examining the relationship between technological applications and consumer satisfaction

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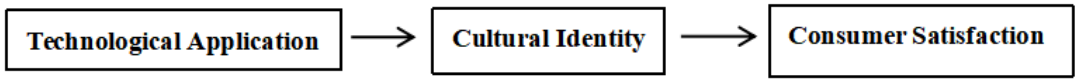


Figure 1. Theoretical Model

1.2.2 Self-Determination Theory and Perceived Value Theory

(1) Self-Determination Theory (SDT)

Self-Determination Theory (SDT), proposed by Deci and Ryan in the late 1980s, is a classical framework for explaining the formation and transformation of human motivation [13]. The theory posits that the activation of intrinsic motivation depends on the satisfaction of three basic psychological needs: autonomy, competence, and relatedness. Liu Lihong and Zhang Jijia (2010) further integrated SDT with cultural identity, suggesting that cultural identity is a process through which individuals establish a "self–culture" connection by fulfilling these psychological needs within a cultural context. Gu Qiushi et al. (2025) further emphasize that the fulfillment of relatedness needs is particularly critical, as it elevates cultural identity from "individual cognition" to "collective emotional resonance," thereby enhancing its stability [14].

In the context of cultural heritage revitalization, technological applications serve as key vehicles for satisfying these psychological needs. For example, digital technologies, such as online cultural resource databases, enable consumers to explore content independently, thereby fulfilling autonomy needs. Virtual reality technologies provide immersive and interactive experiences, enhancing individuals' sense of efficacy in cultural engagement and satisfying competence needs. New media technologies facilitate communication and connection among consumers, thereby addressing relatedness needs. Collectively, these technologies construct a comprehensive cultural experience environment that allows consumers to perceive their connection to cultural inheritance, thereby fulfilling their need for social value.

(2) Perceived Value Theory

Perceived Value Theory was first systematically proposed by marketing scholar Zeithaml in 1988. Its core premise is that, during decision-making processes, consumers subjectively evaluate and trade off the "benefits" (e.g., functional, experiential, and emotional benefits) against the "costs" (e.g., monetary, time, and effort costs), ultimately forming an overall value judgment of a product or service [15]. This theory moves beyond the traditional focus on single factors such as price or quality, offering a multidimensional perspective for understanding the formation of consumer satisfaction.

Subsequent research has expanded perceived value into multiple dimensions, including functional value, emotional value, social value, and cognitive value [16]. Some studies further indicate that, in cultural heritage tourism, non-utilitarian factors such as emotional experience and cultural identity exert particularly significant influence on perceived value [17]. Technological applications can enhance these value dimensions through different mechanisms: digital technologies reduce information acquisition costs and improve functional value; virtual reality technologies create immersive experiences that stimulate emotional value; and new media technologies strengthen a sense of belonging within cultural communities, thereby enhancing social value. The enhancement of perceived value further reinforces cultural identity and ultimately influences consumer

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satisfaction.

1.2.3 Tourist Satisfaction Theory

Tourist Satisfaction Theory emerges from the intersection of consumer behavior and service management, with its core grounded in the "expectation–experience discrepancy" mechanism. It serves as a key metric for evaluating the effectiveness of cultural heritage revitalization. Foundational contributions from international scholarship have shaped this framework. Pizam et al. (1978) first defined tourist satisfaction as the psychological outcome of comparing prior expectations with actual experiences, thereby establishing the "expectation–discrepancy" evaluation standard. Beard et al. (1980) further refined this perspective by emphasizing the affective nature of satisfaction, defining it as a positive emotional perception [18].

Chinese scholars have expanded this framework within localized research contexts. Zhou Bin, Yu Hu, et al. (2022), in their study of traditional villages in southern Anhui such as Xidi and Hongcun, found that cultural cognition exerts a significant influence on tourist satisfaction, with a coefficient as high as 0.510—substantially exceeding that of emotional and aesthetic experiences [19]. This finding reveals a distinctive feature of cultural heritage tourism in China, characterized by the primacy of cultural cognition in shaping satisfaction. It not only diverges from Western research, which often emphasizes entertainment and emotional dimensions, but also extends the applicability of Pine and Gilmore's (1998) "4Es" framework within the Chinese context. Moreover, it provides a theoretical basis for incorporating cultural identity into the analytical framework of satisfaction.

This theory offers an evaluative foundation for the transmission pathway of "technological application → cultural identity → consumer satisfaction." Specifically, technological applications must enhance the quality of cultural experiences and reduce the gap between cultural expectations and actual experiences in order to improve satisfaction. Cultural identity, in this process, functions as the critical psychological mechanism that facilitates the transformation from "technological experience" to "consumer satisfaction."

2. Research Hypotheses

Building on the theoretical foundations outlined above and their relevance to the activation of cultural heritage, this study adopts the core analytical framework of "technology application (S) → cultural identity (O) → consumer satisfaction (R)". It further refines the transmission mechanisms among variables and proposes the following hypotheses.

2.1 Technology Application and Consumer Satisfaction

According to the foundational logic of the S-O-R model—stimulus → response—and the central proposition of tourist satisfaction theory that experience quality determines satisfaction, different types of technology can enhance the quality of cultural heritage experiences in distinct ways. Digital technologies improve cognitive efficiency through systematic preservation and convenient access to cultural resources. New media technologies enhance engagement and interest through social dissemination and accessible interpretation. Virtual reality (VR) technologies deepen emotional experience through immersive interaction and scenario reconstruction. All three types of technologies contribute directly to improving the quality of cultural heritage

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experiences, thereby exerting a positive influence on consumer satisfaction.

H1.1–H1.3: Technology application (digital technology, new media technology, and virtual reality technology) has a positive effect on consumer satisfaction.

2.2 Technology Application and Cultural Identity

Drawing on Self-Determination Theory and Perceived Value Theory, technology application can strengthen cultural identity by satisfying consumers' basic psychological needs—autonomy, competence, and relatedness—as well as their need for social value. The self-directed search functions of digital technologies fulfill the need for autonomy. The interactive and experiential features of VR technologies satisfy the need for competence. The social connectivity enabled by new media technologies addresses the need for relatedness. Together, these technologies create cultural experience scenarios that fulfill consumers' sense of social value.

H2.1–H2.4: Technology application has a positive effect on cultural identity (autonomy, competence, relatedness, and social value).

2.3 Cultural Identity and Consumer Satisfaction

Based on the localized extension of tourist satisfaction theory (Zhou et al., 2022), cultural cognition, a core dimension of cultural identity, is a key determinant of satisfaction in heritage tourism. Meanwhile, Self-Determination Theory suggests that satisfaction of basic psychological needs generates positive emotional responses. Perceived Value Theory confirms that emotional and social value positively influence satisfaction. The four dimensions of cultural identity represent consumers' positive psychological processing of cultural experiences, which in turn enhances satisfaction.

H3: Cultural identity has a positive effect on consumer satisfaction.

2.4 The Mediating Role of Cultural Identity

Following the S-O-R framework's stimulus → organism → response logic, cultural identity functions as the organism (O) variable that mediates between technology application (S) and consumer satisfaction (R). In this process, Technology application first activates cultural identity by satisfying psychological needs (autonomy, competence, relatedness) and social value. Cultural identity then transforms this psychological activation into positive evaluations of the experience, i.e., consumer satisfaction.

H4.1–H4.4: Cultural identity (autonomy, competence, relatedness, and social value) mediates the relationship between technology application and consumer satisfaction.

3. Research Methodology

3.1 Sample Selection and Data Collection

Given the study's focus on the core theme of technology-enabled activation of rural cultural heritage, the selection of samples followed three key principles: diversity of heritage types, significant technological application, and strong regional representativeness. Based on these criteria, six representative villages in Zhejiang

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Province were selected as case sites: Yan Village, Gouxi Village, Yudong Village, and Miaoyuan Village in Quzhou; Dagangtou Village in Lishui; and Yong'an Village in Hangzhou. These villages encompass a wide range of heritage types, including tangible cultural heritage (e.g., traditional architectural complexes in Miaoyuan Village and agricultural heritage remains in Yan Village) and intangible cultural heritage (e.g., the Kong family ritual in Gouxi Village and peasant painting traditions in Yudong Village). All selected sites have introduced modern technologies to support heritage activation practices. Notably, some villages—such as Yudong and Dagangtou—have been recognized as provincial demonstration cases of technology-driven cultural heritage revitalization. This selection ensures comprehensive coverage of both technological application scenarios and heritage categories relevant to the study.

Data collection was conducted from July 5 to July 25, 2025. The research team carried out fieldwork across all six sites, primarily using on-site questionnaire distribution, supplemented by in-depth interviews and field observations. Prior to the formal survey, the team communicated with village administrators and cultural tourism project managers to explain the research objectives and procedures, securing their support. Respondents were recruited in key locations such as cultural heritage experience zones and visitor service centers. To improve data quality, a one-on-one guided questionnaire completion approach was adopted to minimize response bias. Additionally, attention-check items were embedded to identify invalid responses—for example, paired statements such as "During my visit, I felt capable and effective in understanding the cultural content" versus "During my visit, I felt incapable of understanding the cultural content." A total of 452 questionnaires were distributed. After rigorous screening, 56 invalid responses (e.g., incomplete answers, uniform scoring patterns, or logical inconsistencies) were removed, resulting in 396 valid questionnaires, with an effective response rate of 87.61%.

In terms of sample characteristics, the gender distribution was balanced (50.25% female, 49.75% male). The age structure was broad, with the largest group being 31–45 years old (27.53%), while also covering respondents from under 18 to over 60. Most visitors were from the local city (79.55%) or other areas within Zhejiang Province (19.44%), consistent with typical rural tourism demographics. Occupational backgrounds were diverse, including students (32.07%), freelancers (27.78%), and salaried employees (22.22%), among others. Educational and income levels were widely distributed. Notably, the majority of respondents reported a moderate or limited understanding of rural culture (70.70%), aligning closely with the general profile of cultural heritage tourists in rural contexts.

3.2 Measurement of Variables

All variables in this study were measured using well-established scales developed by both domestic and international scholars. The original English instruments were adapted through a rigorous translation–back translation procedure to ensure linguistic accuracy and cultural appropriateness in the local context. To further ensure the reliability and validity of the survey instrument, a pilot study was conducted with a randomly selected subset of respondents (excluded from the final sample). Based on participant feedback and expert panel review, ambiguous or unclear items were carefully revised to enhance clarity and measurement precision. All measurement items were assessed using a five-point Likert scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree").

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Table 1. Measurement Scale Design

Variable	Item	Source
Digital Technology (Preservation)	Digital technologies (e.g., 3D scanning, environmental monitoring) effectively preserve the village's cultural heritage (e.g., traditional architecture, craftsmanship, and folk customs).	Zhou, 2021 [20]
	Digital technologies (e.g., 3D scanning, environmental monitoring) provide accurate representations of the village's cultural heritage (e.g., traditional architecture, craftsmanship, and folk customs).	
New Media Technology (Transmission)	New media formats such as short videos and livestreaming present cultural heritage (e.g., legends and traditional skills) in a clear and understandable way.	Yang, 2016[21]
	New media formats such as short videos and livestreaming offer effective interactive functions for presenting cultural heritage (e.g., legends and traditional skills).	
Virtual Reality Technology (Utilization)	VR/AR technologies enable me to immerse myself in traditional rituals (e.g., ceremonies and festivals), as if traveling through time.	Gong, 2023[22]
	Immersive interactions (e.g., virtual restoration of artifacts, role-playing) stimulate my interest in actively exploring cultural meanings.	
Autonomy Need	I can choose cultural experience content (e.g., AR-guided routes, DIY activities) according to my own preferences.	Ryan & Deci (SDT); Liu Junsheng scale revision [23]
	Technology applications allow me to freely control the pace of my experience (e.g., pause/replay explanations).	
	During my visit, I was attracted by cultural elements rather than external pressure.	La Guardia, 2000[24]
	I have autonomy in deciding how to experience tourism in this village.	
	During my visit, I mostly acted according to my own preferences.	
Competence Need	Through this experience, I acquired new knowledge about cultural heritage (e.g., Quzhou bamboo weaving techniques).	Zhao & Fu, (2016)[25]
	I am able to skillfully use technological tools (e.g., QR-code interaction, VR devices) to obtain cultural information.	
	I feel that I have made progress through visiting this village.	
	During my visit, I felt capable and effective in understanding cultural content.	La Guardia , 2000[24]
	I am satisfied with my performance during the visit.	
Relatedness Need	During my visit, I felt incapable of understanding cultural content.	La Guardia, 2000[24]
	During my visit, I was able to communicate well with others.	
	During my visit, I was able to integrate into community or forum-based activities.	
	During my visit, I felt that I was part of the user/community group.	
Social Value	During my visit, I made new friends and experienced a sense of belonging.	Adapted from Sweeney & Soutar (2001)
	During my visit, I made a positive impression on others.	
	During my visit, I felt recognized by others.	
Consumer Satisfaction	Overall, I am satisfied with this trip (including rural culture, forms of cultural presentation, recreational facilities, and staff service attitudes).	Lee et al. (2007); Lu et al. (2015)
	The activation forms (e.g., VR interaction, intangible cultural heritage DIY activities) met my expectations.	
	I am satisfied with the time and money spent on this trip.	

The Cronbach's α coefficients for the three core variables are reported in Table 2. All coefficients exceed 0.80, indicating strong internal consistency. These results confirm that the measurement scales demonstrate

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satisfactory reliability and that the dataset is suitable for subsequent analysis.

Table 2. Reliability Analysis of the Measurement Scales

Variable	Cronbach's α coefficient	Dimension	No. of Items	Cronbach's α
Stimulus (S): Technology Application	0.819	Digital Technology	2	0.676
		New Media Technology	2	0.675
		Virtual Reality Technology	2	0.678
Organism (O): Cultural Identity	0.824	Autonomy Need	5	0.88
		Competence Need	6	0.96
		Relatedness Need	3	0.86
		Social Value	3	0.86
Response (R): Consumer Satisfaction	0.805	/	3	/

4. Results Analysis

4.1 Exploratory Factor Analysis

Exploratory factor analysis was conducted using SPSS 22.0 with the principal component analysis method. To enhance the interpretability of the factor structure, an orthogonal rotation (Varimax) was applied.

A total of 17 measurement items were analyzed, yielding four common factors, which correspond to the following constructs: Personal Growth and Competence Enhancement, autonomy and Sense of Control, social Integration and Reverse Perception of Competence, and social Identity and Interpersonal Interaction.

The factor loadings demonstrate strong convergence: all loadings for Factor 1 exceed 0.87, for Factor 2 exceed 0.79, for Factor 3 exceed 0.82, and for Factor 4 exceed 0.72. In addition, communalities are generally high, indicating that the extracted factors adequately explain the variance of the observed variables.

Table 3. Total Variance Explained

Factor	Initial Eigenvalue			Variance Explained Before Rotation			Variance Explained After Rotation		
	Initial Eigenvalue	Variance Explained (%)	Cumulative (%)	Rotated Eigenvalue	Variance Explained (%)	Cumulative (%)	Initial Eigenvalue	Variance Explained (%)	Cumulative (%)
1	3.7	23.125	23.125	3.086	19.288	19.288	3.086	19.288	19.288
2	1.738	10.86	33.985	1.085	6.781	26.069	1.085	6.781	26.069
3	1.218	7.615	41.6	0.619	3.87	29.939	0.619	3.87	29.939
4	1.163	7.266	48.866	0.517	3.232	33.171	0.517	3.232	33.171

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Table 4. Rotated Factor Loading Matrix

Factor	Measurement Item	Factor Loading
Factor 1: Personal Growth and Competence Enhancement	I can skillfully use technological tools to obtain cultural information during my visit.	0.887
	I feel that I have made progress through visiting this village.	0.884
	I feel capable and effective in understanding cultural content during my visit.	0.883
	Through this experience, I have acquired new cultural heritage knowledge.	0.882
	I am satisfied with my performance during the visit.	0.875
Factor 2: Autonomy and Sense of Control	During my visit, I am attracted by cultural elements rather than external pressure.	0.922
	I have autonomy in deciding how to experience tourism in this village.	0.920
	I can choose cultural experience content based on my own preferences (e.g., AR routes, DIY activities).	0.870
	Technology allows me to control the pace of my experience.	0.830
	During my visit, I mostly act according to my own preferences.	0.796
Factor 3: Social Integration and Reverse Perception of Competence	I am able to integrate into community or forum-based activities during my visit.	0.893
Factor 4: Social Identity and Interpersonal Interaction	I made new friends and gained a sense of belonging during my visit.	0.897
	I feel recognized by others during my visit.	0.879
	I made a positive impression on others during my visit.	0.866
	I am able to communicate well with others during my visit.	0.722

4.2 Correlation Analysis of Major Variables

Pearson correlation analysis was conducted to examine the relationships between the independent variables and the dependent variable (consumer satisfaction), as well as the mediating variables. As shown in Table 5, the results indicate that digital technology application is significantly and positively correlated with consumer satisfaction (correlation coefficients ranging from 0.692 to 0.811, all $p < 0.01$). Similarly, new media technology application demonstrates a significant positive correlation with consumer satisfaction (correlation coefficients ranging from 0.760 to 0.900, all $p < 0.01$). Since among the six surveyed villages only Dagangtou Village in Lishui has implemented virtual reality technology, a separate correlation analysis was conducted for this case (see Table 6). The results show that virtual reality technology is moderately positively correlated with consumer satisfaction. Therefore, hypotheses H1.1–H1.3 are supported.

To examine the relationship between independent variables and mediating variables, the results in Table 7 indicate that technology application is significantly and positively correlated with all four dimensions of cultural identity: Autonomy need ($r = 0.367$, $p < 0.01$), Competence need ($r = 0.409$, $p < 0.01$), Relatedness need ($r = 0.296$, $p < 0.01$), Social value ($r = 0.388$, $p < 0.01$). These findings support hypotheses H2.1–H2.4.

Furthermore, the relationships between the mediating variables and the dependent variable were tested (see Table 8). The results show that: Consumer satisfaction is moderately positively correlated with social value (r

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= 0.472, p < 0.01), indicating that higher perceived social value is associated with higher overall satisfaction. Consumer satisfaction is also moderately positively correlated with competence need (r = 0.445, p < 0.01), suggesting that better fulfillment of competence needs enhances satisfaction in rural tourism experiences. A weak positive correlation exists between consumer satisfaction and autonomy need (r = 0.365, p < 0.01), indicating a positive but relatively modest effect. Consumer satisfaction is weakly positively correlated with relatedness need (r = 0.246, p < 0.01). Overall, these results provide empirical support for Hypothesis H3.

Table 5. Correlation Matrix of Independent and Dependent Variables

Variable			S (Stimulus)				R (Response)		
			Digital Technology Preservation		New Media Technology Transmission		Consumer Satisfaction		
			S1A	**S1B**	**S2A**	**S2B**	**RA**	**RB**	**RC**
S	Digital Technology Preservation	S1A	0.781**						
	New Media Technology Transmission	S2A	0.767**	0.767**					
		S2B	0.692**	0.692**	0.787**				
R	Consumer Satisfaction	RA	0.170*	0.170*	0.165*	0.201**			
		RB	0.187**	0.187**	0.176*	0.231**	0.871**		
		RC	0.142	0.142	0.136	0.170*	0.760**	0.900**	

Table 6. Correlation Matrix of Virtual Reality Technology and Consumer Satisfaction

Variable	**Mean**	**SD**	**1**	**2**	**3**	**4**	**5**
1. VR/AR technology enables immersive participation in traditional rituals (e.g., ceremonies, festivals), creating a sense of "time travel"	4.075	0.851	1				
2. Immersive interaction (e.g., virtual artifact restoration, role-playing) stimulates my interest in exploring cultural meanings	4.113	0.61	-0.128	1			
3. Overall, I am satisfied with this tourism experience	4.208	0.631	-0.101	0.038	1		
4. Revitalization formats (e.g., VR interaction, intangible heritage DIY) met my expectations	4.189	0.681	-0.125	0.365**	-0.003	1	
5. I am satisfied with the time and money spent on this trip	4.17	0.727	0.290*	0.173	-0.078	-0.066	1
* p<0.05 ** p<0.01							

Table 7. Correlation Matrix of Independent Variables and Mediating Variables

	Variable	**Mean**	**SD**	**1**	**2**	**3**	**4**	**5**
O	S	3.41	0.781	1				
	Autonomy Need	3.487	0.708	0.367**	1			
	Competence Need	3.46	0.653	0.409**	0.321**	1		
	Relatedness Need	2.757	0.648	0.296**	0.102*	0.184**	1	
	Social Value	3.432	0.74	0.388**	0.329**	0.348**	0.241**	1
* p<0.05 ** p<0.01								

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Table 8. Correlation Matrix of Mediating Variables and Dependent Variable

	Variable	Mean	SD	1	2	3	4	5
O	Autonomy Need	3.487	0.708	1				
	Competence Need	3.46	0.653	0.321**	1			
	Relatedness Need	2.757	0.648	0.102*	0.184**	1		
	Social Value	3.432	0.74	0.329**	0.348**	0.241**	1	
	R	3.725	0.816	0.365**	0.445**	0.246**	0.472**	1

* p<0.05 ** p<0.01

4.3 Mediation Analysis of Cultural Identity

The mediation effects were tested using the Bootstrap method with 5,000 resamples. As shown in Table 9, the impact of technology application on consumer satisfaction is fully mediated by the four dimensions of cultural identity.

Table 9. Summary of Mediation Effects

Path	c Total Effect	a	b	a*b Indirect Effect	a*b (Boot SE)	a*b (z-value)	a*b (p-valu)	a*b (95% BootCI)	Direct Effect (c')	**Conclusion**
S=>O1=>R	0.339**	0.332**	0.195**	0.109	0.022	4.978	0.000**	0.069 ~ 0.155	0.009	Full mediation
S=>O2=>R	0.339**	0.342**	0.332**	0.160	0.028	5.657	0.000**	0.107 ~ 0.218	0.009	Full mediation
S=>O3=>R	0.339**	0.245**	0.134**	0.050	0.015	3.264	0.001**	0.022 ~ 0.082	0.009	Full mediation
S=>O4=>R	0.339**	0.367**	0.325**	0.165	0.027	6.208	0.000**	0.116 ~ 0.221	0.009	Full mediation

Note:

* p<0.05 ** p<0.01

Bootstrap type = percentile Bootstrap method

4.3.1 Mediation Effect of Autonomy Need

To test Hypothesis 4.1—that the autonomy need dimension of cultural identity mediates the relationship between technology application and consumer satisfaction—a Bootstrap-based mediation analysis was conducted. The results are as follows:

(1) Total effect (c): The overall effect of technology application on total consumer satisfaction is significant ($b = 0.339$, $p < 0.001$), indicating that higher levels of technology application are associated with higher consumer satisfaction.

(2) Path a: Technology application has a significant positive effect on autonomy need ($b = 0.332$, $p < 0.001$).

(3) Path b: After controlling for technology application, autonomy need exerts a significant positive effect

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on total consumer satisfaction (b = 0.195, p < 0.001).

(4) Direct effect (c′): After including autonomy need as a mediating variable, the direct effect of technology application on consumer satisfaction becomes non-significant (b = 0.009, p = 0.857).

(5) Indirect effect (a × b): Bootstrap results indicate that the mediating effect of autonomy need is significant (effect = 0.109, SE = 0.022, 95% CI [0.069, 0.155], p < 0.001).

Taken together, these findings demonstrate that autonomy need fully mediates the relationship between technology application and consumer satisfaction. Therefore, Hypothesis H4.1 is supported.

4.3.2 Mediation Analysis of Competence Need

To test Hypothesis 4.2—that the competence need dimension of cultural identity mediates the relationship between technology application and consumer satisfaction—a Bootstrap mediation analysis was conducted. The results are as follows:

(1) Total effect (c): The total effect of technology application on consumer satisfaction remains significant (b = 0.339, p < 0.001).

(2) Path a: Technology application has a significant positive effect on competence need (b = 0.342, p < 0.001).

(3) Path b: After controlling for technology application, competence need has a significant positive effect on consumer satisfaction (b = 0.332, p < 0.001).

(4) Direct effect (c′): After including competence need as a mediator, the direct effect of technology application on consumer satisfaction becomes non-significant (b = 0.009, p = 0.857).

(5) Indirect effect (a × b): Bootstrap results show that the mediating effect of competence need is significant (effect = 0.160, SE = 0.028, 95% CI [0.107, 0.218], p < 0.001).

In summary, competence need fully mediates the relationship between technology application and consumer satisfaction. Therefore, Hypothesis H4.2 is supported.

4.3.3 Mediation Analysis of Relatedness Need

To test Hypothesis 4.3—that the relatedness need dimension of cultural identity mediates the relationship between technology application and consumer satisfaction—a Bootstrap mediation analysis was conducted. The results are as follows:

(1) Total effect (c): The total effect of technology application on overall consumer satisfaction is significant (b = 0.339, p < 0.001).

(2) Path a: Technology application has a significant positive effect on relatedness need (b = 0.245, p < 0.001).

(3) Path b: After controlling for technology application, relatedness need has a significant positive effect on consumer satisfaction (b = 0.134, p = 0.009).

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(4) Direct effect (c′): After including relatedness need as a mediating variable, the direct effect of technology application on consumer satisfaction becomes non-significant (b = 0.009, p = 0.857).

(5) Indirect effect (a × b): Bootstrap results indicate that the mediating effect of relatedness need is significant (effect = 0.050, SE = 0.015, 95% CI [0.022, 0.082], p = 0.001).

In summary, relatedness need fully mediates the relationship between technology application and consumer satisfaction. Therefore, Hypothesis H4.3 is supported.

4.3.4 Mediation Analysis of Social Value

To test Hypothesis 4.4—that the social value dimension of cultural identity mediates the relationship between technology application and consumer satisfaction—a Bootstrap mediation analysis was conducted. The results are as follows:

(1) Total effect (c): The total effect of technology application on consumer satisfaction remains significant (b = 0.339, p < 0.001).

(2) Path a: Technology application has a significant positive effect on social value (b = 0.367, p < 0.001).

(3) Path b: After controlling for technology application, social value has a significant positive effect on consumer satisfaction (b = 0.325, p < 0.001).

(4) Direct effect (c′): After including social value as a mediating variable, the direct effect of technology application on consumer satisfaction becomes non-significant (b = 0.009, p = 0.857).

(5) Indirect effect (a × b): Bootstrap results show that the mediating effect of social value is significant (effect = 0.165, SE = 0.027, 95% CI [0.116, 0.221], p < 0.001).

Taken together, social value fully mediates the relationship between technology application and consumer satisfaction. Therefore, Hypothesis H4.4 is supported.

Table 10. Summary of Research Findings

Path	Research Hypothesis	Result
Independent Variable → Dependent Variable	H1.1: Digital technology application positively affects consumer satisfaction.	Supported
	H1.2: New media technology application positively affects consumer satisfaction.	Supported
	H1.3: Virtual reality technology application positively affects consumer satisfaction.	Supported
Independent Variable → Mediating Variable	H2.1: Technology application positively affects autonomy need.	Supported
	H2.2: Technology application positively affects competence need.	Supported
	H2.3: Technology application positively affects relatedness need.	Supported
	H2.4: Technology application positively affects social value.	Supported
Mediating Variable → Dependent Variable	H3: Cultural identity positively affects consumer satisfaction.	Supported

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Path	Research Hypothesis	Result
Mediation Effect	H4.1: Autonomy need within cultural identity mediates the relationship between technology application and consumer satisfaction.	Full mediation
	H4.2: Competence need within cultural identity mediates the relationship between technology application and consumer satisfaction.	Full mediation
	H4.3: Relatedness need within cultural identity mediates the relationship between technology application and consumer satisfaction.	Full mediation
	H4.4: Social value within cultural identity mediates the relationship between technology application and consumer satisfaction.	Full mediation

5. Conclusion

5.1 Research Findings

Grounded in the S-O-R framework and integrating self-determination theory and perceived value theory, this study employs systematic empirical analysis to clarify the full transmission mechanism through which technology application influences consumer satisfaction in the context of cultural heritage revitalization. First, digital technology, new media technology, and virtual reality technology—conceptualized as key external stimuli—effectively overcome longstanding limitations in traditional heritage development, such as one-way information delivery and rigid experiential formats. These technologies align closely with the evolving consumer demand for personalized, immersive, and interactive experiences, thereby exerting a significant positive influence on consumer satisfaction. Second, cultural identity functions as a full mediator between technology application and consumer satisfaction. Its four dimensions—autonomy need, competence need, relatedness need, and social value—exhibit differentiated mediating effects. Among these, social value and competence need demonstrate the strongest mediating power, serving as critical mechanisms through which technological value is translated into experiential evaluation. In contrast, the relatively weaker mediating role of relatedness need suggests that current technological applications still have considerable room for improvement in fostering social interaction and relational engagement.

5.2 Theoretical Contributions

Addressing key limitations in existing research—such as an overemphasis on technological pathways at the expense of psychological mechanisms, insufficient quantitative analysis, and fragmented theoretical models—this study makes three primary theoretical contributions. First, it develops a systematically integrated analytical model that fills a notable research gap. Building upon the S-O-R framework, the study incorporates the basic psychological needs from self-determination theory and the social value dimension from perceived value theory, thereby constructing a comprehensive "technology stimulus–psychological perception–satisfaction response" pathway. This integrated model resolves the disconnect commonly observed in prior research between technology application and consumer satisfaction, offering a more coherent and explanatory framework for cultural heritage revitalization studies. Second, the study extends the theoretical scope and applicability of existing frameworks. It adapts the S-O-R model—traditionally applied in e-commerce and

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urban tourism contexts—to the domain of rural cultural heritage revitalization. Moreover, it operationalizes the "organism" component as four measurable dimensions of cultural identity and, in conjunction with the elaboration likelihood model, differentiates between central and peripheral processing routes. This approach enriches both the contextual application and theoretical depth of these frameworks within culturally specific settings. Third, the study advances the methodological rigor of quantitative research in this field. Through the development of standardized measurement scales and rigorous reliability and validity testing, it establishes a robust and operationalizable analytical tool. In doing so, it facilitates a shift in cultural heritage revitalization research from predominantly qualitative description toward quantitative empirical investigation, providing a methodological reference for future studies.

5.3 Practical Implications

Based on the findings, this study proposes three actionable strategies to support rural cultural heritage revitalization, cultural-tourism integration, and rural revitalization.

First, optimize technology selection to improve resource allocation efficiency. A differentiated technological application system should be developed according to the distinct characteristics of tangible and intangible cultural heritage. This helps avoid the pitfall of "technology over culture" and ensures that technological deployment remains aligned with the core goals of cultural meaning transmission and experience enhancement. Second, prioritize key experiential dimensions to strengthen cultural identity formation. With social value and competence needs as focal points, strategies such as co-creation experiences and tiered task design can enhance participants' sense of cultural ownership and achievement. Additionally, incorporating preparatory cultural content can lower cognitive barriers and facilitate the transformation of technological engagement into emotional resonance and deeper cultural identification. Third, implement segmented service strategies to address diverse audience needs. By accommodating variations in age, knowledge level, and user preferences, a differentiated technological service system can be established. This approach balances personalized experiences with broad accessibility, promoting a shift from one-time sightseeing to repeated, in-depth engagement, and ultimately achieving both social and economic benefits in cultural heritage revitalization.

5.4 Limitations and Future Research

Despite its contributions, this study has several limitations that warrant further investigation. First, the sample is limited to rural areas in Zhejiang Province. While these cases are representative, the regional scope may constrain the generalizability of the findings. Second, the use of cross-sectional data limits the ability to capture dynamic changes in technological application and consumer perception over time. Third, the study does not incorporate emerging technologies such as AI-guided tours and digital twins, nor does it consider potential moderating variables such as technology acceptance, leaving room for expanded analytical perspectives. Fourth, the research focuses exclusively on rural cultural heritage contexts and does not examine other settings such as urban museums or revolutionary heritage sites, where different technological logics may apply.

Future research can be extended in four directions. First, expand the sample scope to include rural areas from central and western China, enabling comparative regional analyses and more differentiated technological strategies. Second, adopt longitudinal research designs combined with qualitative methods such as in-

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depth interviews to explore the long-term evolution of technology use, cultural identity, and satisfaction. Third, broaden variable dimensions by incorporating emerging technologies and moderating factors to refine the boundaries and mechanisms of technological influence. Fourth, diversify research contexts by comparing different types of cultural heritage revitalization, thereby developing cost-effective and adaptable technological solutions. Such efforts will help advance cultural heritage revitalization from experiential enhancement to industrial empowerment, contributing to both cultural revitalization and comprehensive rural development.

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