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Analyzing the dissemination path mechanism of China's rural cultural heritage in Rizhao based on the improved TTF-UTAUT combined model:Taking Rizhao green tea as the research object

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Abstract

Rural cultural heritage dissemination is increasingly supported by digital technologies, yet the mechanisms that influence users' participation in cultural communication remain unclear. Taking Rizhao green tea (RZT) as a case of rural cultural heritage, this study develops an integrated framework based on the Task–Technology Fit (TTF) and Unified Theory of Acceptance and Use of Technology (UTAUT) models to examine how digital media platforms influence users' cultural dissemination behavior. A questionnaire survey was conducted through online and offline channels, yielding 1,442 valid responses. The data were analyzed using SPSS and AMOS with structural equation modeling (SEM). The results show that task characteristics, technology characteristics, cultural awareness, performance expectancy, effort expectancy, social influence, and facilitating conditions all have significant positive effects on task–technology fit. Task–technology fit significantly enhances users' intention to use digital platforms for cultural experiences, which further promotes actual dissemination behavior. These findings indicate that both technological suitability and cultural perception play key roles in motivating users to participate in digital cultural heritage communication. This study extends the application of the TTF–UTAUT integrated model to rural cultural heritage dissemination and provides insights for improving digital strategies in the promotion of traditional tea culture.

Introduction

After the 1970s, following the adoption of the UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage, there has been a clear global trend toward safeguarding both natural and cultural heritage, with numerous protection initiatives emerging rapidly [1]. The Chinese government seeks to leverage rural cultural heritage as a resource for development, aiming to promote economic growth and cultural enrichment in rural areas, while offering new pathways for rural revitalization [2, 3]. Rizhao Green Tea (RZT) [4] represents a rare living heritage of tea culture in northern China. This legacy owes its existence to the "Introduction of Southern Tea to the North" project in 1966 [5], which successfully brought the charm of Jiangnan tea to northern regions and dispelled the long-held belief that tea could not thrive above the 30th parallel north [6]. RZT embodies a rich cultural heritage and historical significance, exemplifying the resilience and adaptive renewal of China's traditional tea culture system.

To address the limitation of a single dissemination pathway for RZT as a cultural heritage, this study adopts an improved TTF-UTAUT model to explore strategies for leveraging digital media technology platforms to expand the channels for RZT cultural communication. Structural Equation Modeling (SEM) is then employed to test the proposed path hypotheses and conduct a comprehensive research analysis.

In rural Rizhao, the significance of RZT extends far beyond that of an ordinary cash crop. Tea-picking culture [7], tea-frying techniques [8], tea-serving etiquette [9], and folk tea activities [10] together represent an organic integration of material production practices and intangible behavioral norms, forming a cluster of RZT rural cultural heritage with distinct regional characteristics. Compared to the tea charm of Jiangnan, RZT exhibits unique qualities, including a bright yellow-green infusion, a rich chestnut aroma, a sweet and mellow aftertaste, thick leaves, pronounced fragrance, and strong infusion resistance [11, 12], earning it the title of "the new aristocrat of Chinese green tea." RZT also embodies the integration of diverse tea culture characteristics, harmoniously blending contrasts: it reflects both the elegant and tranquil essence of the ancient Chinese tea ceremony and the bold, rustic style characteristic of northern China. This duality positions RZT as an important element in the long history of traditional Chinese tea culture. Therefore, exploring how modern technological tools can enhance the dissemination of RZT culture, and analyzing the effectiveness and acceptance of such technology through a combined Task-Technology Fit (TTF) and Unified Theory of Acceptance and Use of Technology (UTAUT) model, is of great significance. Investigating the mechanisms of RZT dissemination as a rural cultural heritage represents a meaningful step.

China is recognized as the birthplace of tea culture [13], with a history of tea consumption tracing back to the 3rd century. In 539 AD, Chinese tea was exported to Japan, marking the first recorded instance of tea consumption outside China. After 1600, Chinese tea began to enter European markets, becoming commercially available, and by 1868, China exported 871,047 tons of tea [14]. During this period, tea emerged as a highly valuable commodity, often equated with gold. Through processes of absorption, adaptation, and local innovation, diverse tea cultures and drinking customs developed in various countries. In the contemporary context of globalization, organizations such as the World Tea Union (WTU) have been established to promote tea culture internationally. Green tea remains the most widely produced and consumed tea in China and enjoys widespread acclaim worldwide. RZT is recognized as one of the few highly esteemed Chinese green tea brands [1]. Promoting RZT as a living rural cultural heritage not only contributes to China's rural revitalization strategy but also carries considerable significance for the global preservation and promotion of cultural heritage.

RZT has achieved notable success within Chinese tea culture; however, it still faces several challenges, including limited dissemination (aging audience), suboptimal user experience (insufficient interactivity), and fragmented information (lack of systematic organization). Previous studies have employed the combined TTF–UTAUT model to explain users' effectiveness and acceptance of digital technology platforms. Yet, with the rapid advancement of digital technologies, user expectations regarding usability and acceptance are becoming increasingly sophisticated. As a rural cultural heritage with distinctive regional characteristics, RZT requires an improved TTF–UTAUT model to identify effective dissemination pathways that enable both tourists and the general public to understand and engage with its culture, thereby promoting its wider adoption. Accordingly, this study focuses on three primary research questions:

RQ1: How does the TTF model of communication technology affect tourists' willingness to act as disseminators of the rural cultural heritage of RZT?

RQ2: In the dissemination of RZT as rural cultural heritage, how do the core constructs of the UTAUT model influence tourists' willingness to adopt and use the technology?

RQ3: Does Use Intension (UI) serve as a mediating or moderating factor within the improved TTF model in the context of RZT dissemination?

The objectives of this study are threefold: (1) to identify key communication tasks and their corresponding technologies, and to propose optimized pathways for effective dissemination; (2) to analyze the core psychological and social factors influencing tourists' acceptance and use of digital media communication

technologies; and (3) to examine the mediating and moderating role of UI within the improved TTF model. Ultimately, the study aims to provide actionable recommendations and strategies to enhance the dissemination and preservation of the rural cultural heritage of RZT.

This study focuses on RZT as the research object and applies an improved TTF–UTAUT model to investigate the communication pathways of RZT as a rural cultural heritage in Rizhao, China. The study is structured into four main sections. The first section introduces the background and significance of the research, highlighting the challenges in disseminating RZT rural cultural heritage and outlining the study's objectives. The second section reviews the theoretical background, examines the current state of research both domestically and internationally, identifies gaps, formulates preliminary hypotheses, and develops the initial conceptual model. The third section details the research methodology, including the tools employed, the design, collection, and processing of survey questionnaires and scales, as well as the analysis of the measurement and structural models. The fourth section presents the discussion and conclusions, emphasizing the study's contributions, limitations, and providing directions for future research.

Literature review and hypothesis

Theory of cultural heritage communication

Cultural heritage serves as a vital link connecting the past, present, and future, and is generally categorized into two types: tangible and intangible [15]. According to UNESCO's World "Natural and Cultural Heritage Convention and the Convention for the Safeguarding of the Intangible Cultural Heritage", tangible cultural heritage primarily includes buildings, architectural complexes, stone inscriptions, murals, and similar physical artifacts, while intangible cultural heritage encompasses social practices, cultural sites, handicrafts, and associated knowledge and skills. RZT represents an external manifestation of the rich traditional culture of the Chinese nation and serves as an important carrier of rural cultural heritage. Leveraging modern digital media technologies to disseminate cultural heritage is a key strategy for promoting the inheritance and revitalization of rural culture [16, 17]. Tea culture, in particular, constitutes a living cultural heritage, wherein tangible elements serve as carriers while intangible practices and concepts form its core. Accordingly, this study focuses on the dissemination pathways of RZT culture, emphasizing the intangible attributes of this rural cultural heritage.

With the continuous advancement of digital technologies, the protection and dissemination of cultural heritage have attracted increasing attention [18]. Safeguarding and promoting intangible cultural heritage serve as an effective means to foster economic growth, support sustainable development, and enhance the competitiveness of rural areas [19]. Several studies exemplify this trend. Zi Yan et al. (2025) emphasized that in the digital dissemination of cultural heritage, the value of modern technology lies not in the technology itself, but in the authenticity and emotional resonance of the content conveyed, as well as in knowledge transfer, highlighting that the dissemination of intangible cultural heritage should be people-centered rather than solely technology-driven [20]. Similarly, Na Hong (2022) argued that digital media and IoT technologies must prioritize authentic interaction and emotional engagement with cultural heritage, aiming to enhance users' identification with it and promote dissemination through immersive and personalized experiences [21]. Both studies converge on the principle that cultural heritage must retain its authenticity and emotional transmission even when disseminated through modern technologies. Furthermore, Pierre Vidaurre-Rojas et al. (2024) asserted that social media serves as a core channel for cultural heritage dissemination, with effectiveness depending on systematic planning, community participation, multi-platform content innovation, and the development and evaluation of sustainable capabilities [22]. Building on these insights, this study seeks to investigate how RZT, as a rural cultural heritage of Rizhao, China, is disseminated under the influence of modern digital media technologies and to analyze its underlying dissemination mechanisms.

Overview of TTF and Cultural Heritage Communication

The TTF model is a theoretical framework designed to examine how technology can enhance performance. It assesses the alignment between technological characteristics and task requirements, evaluating the effectiveness of technology use. Researchers commonly apply TTF to predict users' acceptance and adoption of new technologies [23].

According to Goodhue and Thompson (1995), TTF refers to the degree to which a technology assists individuals in accomplishing their tasks [24]. The model is structured around three core determinants: task characteristics (TAC), technology characteristics (TEC), and the resulting TTF, which together predict user adoption and performance outcomes [25]. TAC encompass users' needs to access relevant information, pursue personal interests, and engage in hobbies, all of which are supported by ubiquitous, real-time services. TEC pertain to digital products that not only provide the required information but also foster supportive virtual communities [26]. The interaction between TAC and TEC determines the TTF, which in turn drives the adoption and effective use of new information systems [27]. Additionally, TTF can be understood as the alignment between technical capabilities and task requirements, or the extent to which technological tools enable individuals to successfully complete their tasks [28].

TTF has been applied in numerous studies across digital cultural heritage and technology adoption contexts. Wei Guo et al. (2025) employed TAM, TTF, and ANN to examine the determinants of designers' satisfaction with the Wencang database, concluding that the integrated TAM + TTF model significantly enhances the ability to explain user satisfaction in digital cultural heritage repositories [29]. Feiyu Zheng et al. (2024) investigated post-pandemic growth trends in museums, focusing on user experience and digital museum design. By combining TTF with the UTAUT and introducing three additional variables, perceived enjoyment, design aesthetics, and perceived cultural value, they clarified users' continued behavioral intentions to use digital museum platforms, noting that TTF had limited influence and that design should emphasize personalized user experience and technology usability [30]. Shan Hu et al. (2024) integrated metaverse technology with education by combining UTAUT, TTF, and Flow Theory. They developed an indicator system that identifies key factors influencing user adoption of metaverse-based cultural heritage education and infers the primary drivers of user intentions. Their study confirmed that TTF significantly promotes users' willingness to engage with cultural heritage metaverse platforms and highlighted the importance of immersive storytelling, technology-task alignment, seamless interaction, and social connectivity in design [31]. Collectively, these studies demonstrate that TTF can effectively

explain users' intentions to continue using digital platforms. However, there is a lack of research examining how TTF influences tourists' willingness to act as communicators of rural cultural heritage, specifically in the context of RZT. Based on this gap, hypotheses H1, H2, and H3 are proposed in the present study:

H1: Do the TAC, specifically leisure experience and learning-sharing activities, on digital media platforms positively influence TTF in this study?

H2: Do the technical characteristics (TEC), namely ease of operation and creative interactivity, of digital media platforms positively influence TTF in this study?

H3: Does TTF positively affect users' UI social media platforms for dissemination in this study?

As a carrier of cultural heritage, RZT embodies multiple TACs related to tea culture dissemination, economic promotion, and emotional engagement. Effective dissemination requires digital technologies that are highly compatible with both content design and interactive experiences. The TTF of communication technology can be employed to evaluate RZT and guide the optimization of technical functions and task design during the communication process. For example, in disseminating RZT culture through graphic and text content on digital media platforms, lightweight AR technology [32] can be utilized to develop a cloud-based tea garden tour using WebXR [33]. Users can navigate the tea mountains in 360 degrees via their phone's gyroscope and follow virtual tea farmers during tea picking. Incorporating panoramic video clips and ASMR tea-picking sound effects [34] into short videos on platforms such as TikTok and Xiaohongshu enhances the immersive experience, thereby improving the effectiveness of RZT cultural dissemination and promoting tourists' willingness to act as communicators of RZT rural cultural heritage.

UTAUT

Before the development of the UTAUT model, numerous theories attempted to explain users' adoption of information technology. However, these theories often addressed only fragmented aspects of adoption and lacked persuasiveness due to significant conceptual overlap. To provide a more comprehensive explanation of users' willingness to adopt emerging technologies, Venkatesh et al. (2003) proposed the UTAUT model. This model integrates eight prior theories, including the Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Innovation Diffusion Theory (IDT), Social Cognitive Theory (SCT), Technology Acceptance Model (TAM), TAM-TAB, and the Motivation Model (MM), to systematically explain users' acceptance and intention to use new technologies [35, 36, 37].

The original UTAUT model comprises four core factors: Performance Expectation (PE), Effort Expectation (EE), Social Influence (SI), and Facilitating Conditions (FC). These factors are moderated by four individual characteristics, age, gender, experience, and voluntariness of use, which influence the relationships among the core variables [38, 39]. PE: Integrating constructs from TAM (perceived usefulness), IDT (relative advantage), MM (extrinsic motivation), and SCT (outcome expectations), PE reflects users' belief that using emerging information systems will enhance their performance [35]. EE: Derived from TAM (perceived ease of use), IDT (complexity), and SCT (self-efficacy), EE represents the perceived ease or effort required to use emerging information systems [35]. SI: Combining TRA/TPB (subjective norms), MPCU (social factors), and IDT (image), SI refers to the impact of important social contacts, such as peers, friends, or instructors, on users' decisions to adopt and use emerging technologies [35]. FC: Integrating TPB (perceived behavioral control), MPCU (FC), and IDT (compatibility), FC denotes the technological and organizational resources available in the user environment that support adoption and use of emerging technologies [35]. UTAUT has been widely applied in domains such as artificial intelligence [40, 41, 42, 43], mobile applications [44, 45], e-commerce[46, 47], and education and learning [48, 49, 50]. The model has been validated to explain up to 70% of the variance in user acceptance intentions, demonstrating its robust explanatory power in information technology adoption. Based on these insights, the following hypotheses are proposed: H4, H5, H6, H7, and H8.

H4: Does the PE in the study have a positive impact on TTF?

H5: Does the EE in research have a positive impact on TTF?

H6: Does the SI in the study have a positive impact on TTF?

H7: Do the FC (platforms, devices, smartphones, policies, social media networks, resource and funding allocation, knowledge and training) in the study have a positive impact on TTF?

H8: Does the UI in the study have a positive impact on usage behavior (UB)?

While TTF provides valuable insights into the alignment between tasks and technology, it does not account for user psychology or social contexts. Conversely, UTAUT emphasizes user acceptance and behavioral intention but overlooks the fit between task requirements and technological characteristics. To address these limitations, this study adopts an improved TTF–UTAUT combined model, applying it to the field of cultural heritage communication and extending the scope of its integrative application. By using RZT as the research object and incorporating situational variables such as cultural perception (CUA), the study develops a more realistic and comprehensive model, offering a novel reference framework for future research in this area.

The effectiveness of disseminating RZT cultural heritage through digital media technologies ultimately depends on the active acceptance and participation of user groups, such as tourists. The core variables of the UTAUT model can help explain this process. For PE, promoting VR experiences should highlight RZT tea gardens and tea-making techniques, emphasizing that digital media platforms offer unique cultural experiences and knowledge. For EE, the interface design of videos or live streams on social media platforms should be intuitive, providing clear explanations and guidance on RZT culture. Regarding SI, renowned cultural disseminators, tea masters, and online influencers can be engaged to promote RZT, leveraging social recognition to enhance users' willingness to participate. FC can be addressed across three dimensions: (1) Policy, resources, and funding, collaboration with local cultural and tourism

departments in Rizhao can integrate digital experiences into smart tourism subsidy projects, securing funding and venue support; (2) Knowledge and training, providing digital tool training for guides and staff in tea gardens and tourist destinations ensures effective offline facilitation; and (3) Integration of social media platforms, developing official mini-programs that combine VR navigation, AR interactions, and e-commerce can reduce access barriers, allowing content to be shared across WeChat, TikTok, Xiaohongshu, Weibo, and other platforms with a single click, while aligning with diverse platform-specific dissemination patterns. By optimizing the dissemination of RZT through the four core UTAUT variables, this approach aims to influence tourists' willingness and behavior, thereby enhancing the spread and engagement with RZT rural cultural heritage.

Current research status at home and abroad

In 2006, RZT was recognized as a landmark geographical agricultural product in Rizhao, with formal measures implemented to protect the product. Since then, its brand value and popularity have ranked highest in Shandong Province. In 2020, under the China–EU Geographical Indication Agreement, RZT was successfully included in the second batch of 175 Chinese geographical indication heritage sites certified by the European Union, ensuring its protection within the EU market [51].

In recent years, research on the dissemination of rural cultural heritage in China has demonstrated a trend toward multidimensional integration and interdisciplinary approaches. The focus has shifted from static preservation to a combined model of technology-driven revitalization and cultural inheritance, aligning closely with the national rural revitalization strategic plan. For example, Cui Zhi Yi et al. (2025) conducted a study in Quanzhou and Yueyang, finding that emotional engagement is a critical factor in enhancing users' digital experiences of intangible cultural heritage. They highlighted the moderating role of cultural identity as a mediating variable, offering valuable insights for rural cultural tourism enterprises to design and disseminate AI-guided virtual cultural experiences [52]. Jia Dai (2025) demonstrated that short videos serve as an effective medium for promoting the intangible cultural heritage of Maonan Opera in Guangxi, emphasizing the need for a systematic, integrated dissemination strategy to support inheritance, promotion, and industrialization for sustainable development [53]. Similarly, ErHang Zhang et al. (2025) argued that Shaanbei folk songs, as a key component of China's intangible cultural heritage, require dissemination strategies that incorporate government policies, school education, public participation, and multimedia communication to enhance visibility domestically and internationally, thereby supporting revitalization, inheritance, and development [54]. Despite the growing body of research, challenges remain, including insufficient attention to both form and connotation, fragmented perspectives lacking systematic analysis, and limited evaluation of short-term effects. Future research should prioritize interdisciplinary exploration, emphasize the regional and endogenous characteristics of cultural dissemination, establish systematic evaluation frameworks, and explore diversified pathways for sustainable development.

Currently, international efforts, exemplified by the European Union, have undergone a paradigm shift in the role of digital technology in disseminating rural cultural heritage. Digital tools have evolved from serving as mere display instruments to establishing ecosystems that foster new relationships and dialogues. Marinos Ioannides et al. (2025), drawing on three EU Horizon projects, TEXTURE, MNEMOSYNE, and IMPACTOUR, developed a systematic digital record of the cultural heritage of Phokaldu village in Cyprus, incorporating multi-party collaboration and sustainable tourism revitalization. Using the e-Fikardou digital platform as a medium, they provided a practical framework for the digital preservation of endangered cultural heritage, the activation of community dynamics, and cross-regional collaborative governance [55]. This work offers a valuable reference paradigm for similar initiatives. Nevertheless, despite numerous EU regulations, many historic villages continue to face challenges such as physical degradation and loss of heritage value. The EU is thus encouraged to explore innovative approaches to heritage conservation, integrating sustainable and resilient rural development with cultural heritage preservation [56].

Based on the current state of domestic and international research, RZT, as a traditional Chinese cultural heritage, can draw valuable lessons from foreign experiences in dissemination and preservation, thereby identifying its own effective pathways and mechanisms.

Cultural awareness

Perception emerges from participation in specific social practices and is shaped by cultural contexts. Richard E. Nisbett et al. (2005) demonstrated that culture is a significant factor influencing human perceptual processes [57]. CUA plays a critical role in driving users' continued willingness to engage with cultural heritage. When individuals perceive that local intangible cultural heritage and traditional customs hold practical or spiritual significance for themselves, they assign value to it. Modern digital technologies or products can enhance the visibility and cultural value of heritage. In the case of RZT, conveying cultural values, historical connotations, regional characteristics, and emotional resonance through digital platforms can strengthen tourists' perception of the heritage. Based on the potential of this enhanced perception to further promote users' willingness to continue engaging with RZT, we propose the following hypothesis: H9.

H9: Does cultural perception in research have a positive impact on TTF?

Based on the hypotheses proposed above, the research model for this study is constructed, as illustrated in Fig. 1.

Research methodology

Sample selection

This study adopts a mixed sampling strategy. According to the survey questionnaire design, the sources of the samples are divided into online and offline channels. For the online component, questionnaires were distributed through mainstream short-video and social media platforms, including TikTok, Xiaohongshu, Weibo, WeChat, and Tencent QQ, focusing on topics related to RZT, green tea culture, and intangible cultural heritage. For the offline

component, surveys were conducted in major tourist gathering areas within the core cultural and tourism zones of Rizhao City, such as Wanpingkou Scenic Area, Haibin National Forest Park, RZT National Agricultural Park, and Rizhao Museum. The use of multiple online and offline channels for data collection aims to reduce the sampling bias that may arise from relying on a single sampling source.

Data collection

Before participating in the survey, respondents were asked to review the basic information provided in the questionnaire and were informed that the study was conducted solely for academic research purposes. The questionnaire was administered from January 10 to January 24, 2026, covering a period of 15 days. A total of 1,586 questionnaires were distributed through both online and offline channels. For the online component, distribution was primarily conducted through the previously mentioned digital communication platforms. For the offline component, data collection was carried out in various cultural and tourism areas across the city through on-site intercept surveys. Because respondents were approached within relevant cultural and consumption contexts, their feedback was more immediate and the survey setting more authentic. During data cleaning, 89 questionnaires were excluded because respondents answered “no contact” to the screening question: “Which digital channels have you accessed to obtain information about tea culture or RZT in the past year?” Additionally, 61 questionnaires completed in less than 140 seconds were considered invalid due to insufficient response time, with six overlapping cases between the two categories. After removing these responses, a total of 1,442 valid questionnaires remained, resulting in an effective response rate of 90.92%. The final sample size is more than thirty times the number of questionnaire items (38 items), indicating that the dataset is adequate for conducting SEM analysis.

The survey results indicate that, among the collected sample data, the gender distribution of respondents was 51.32% male and 48.68% female. In terms of age distribution, 4.02% of respondents were under 18 years old, 31.41% were aged 18–25, 35.64% were aged 26–35, 19.42% were aged 36–45, 8.39% were aged 46–55, and 1.11% were aged 55–65. Regarding educational background, the results show that the majority of tourist respondents (83.84%) had received higher education, specifically a bachelor’s degree or above. In addition, access to tea culture or RZT-related information primarily occurred through short-video platforms (69.56%), social media (68.31%), app websites (65.81%), search engines (65.40%), and online live streaming (57.84%). In contrast, the use of emerging technologies such as VR or AR experiences remained relatively limited, accounting for only 25.8%. These channels demonstrate strong support for users’ needs related to leisure, entertainment, and knowledge acquisition. The detailed demographic characteristics and information access channels are presented in Table 1.

Table 1
Basic information and usage habits statistics of participants.

Project	Option	Number of people	Percentage (%)
Gender	male	740	51.32%
	woman	702	48.68%
Age	under 18	58	4.02%
	age 18–25	453	31.41%
	age 26–35	514	35.64%
	age 36–45	280	19.42%
	age 46–55	121	8.39%
	age56-65	16	1.11%
Educational attainment	junior high school and below	124	8.6%
	high school	109	7.56%
	junior college	438	30.37%
	undergraduate	707	49.03%
	graduate student or above	64	4.44%
Digital channels	short video platforms (tiktok, kwai, etc.)	1003	69.56%
	social media (weChat, weibo, xiaohongshu, etc.)	985	68.31%
	cultural apps/websites (museum official websites, cultural tourism platforms)	949	65.81%
	search engine	943	65.4%
	live streaming (e-commerce, cultural live streaming)	834	57.84%
	vr/ar experience	372	25.8%
	online courses/documentaries	581	40.29%
The purpose of using digital channels	acquire knowledge	985	68.31%
	leisure and entertainment	1021	70.8%
	social sharing	804	55.76%
	shopping reference	746	51.73%
	work/research needs	787	54.58%
total		1442	100%

Data analysis

This study employed SPSS 27.0 and AMOS 26.0 software for data analysis. First, the collected data were imported into SPSS 27.0 for preliminary analysis, including the assessment of skewness, kurtosis, mean values, and standard deviations, in order to examine whether the data conformed to a normal distribution. Second, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were conducted on the research variables to evaluate their reliability and validity. Finally, a SEM was constructed and analyzed using AMOS 26.0 to examine the relationships among the variables. The analysis was divided into two components: the measurement model and the structural model, with goodness-of-fit indices used to evaluate the overall model fit.

Scale analysis

This study adopts a quantitative research approach, and the measurement indicators for the variables in the survey questionnaire were adapted from established scales used in previous studies. These scales were appropriately modified to align with the context of RZT, and were used to test and analyze the hypotheses proposed in this research. The questionnaire items are divided into two main sections: the first section measures constructs related to the improved TTF model, while the second section focuses on variables derived from the UTAUT model. The detailed scale items and their corresponding constructs are presented in Table 2.

Table 2
Scale analysis.

Variable	Item	Source of literature
Task characteristics	tac1:I need to obtain sunshine tea culture resources related to my research content.	[30, 58, 59, 60]
	tac2:I need quick and convenient access to this digital communication platform.	
	tac3:This digital communication platform possesses high-quality knowledge about the culture of Rizhao green tea.	
	tac4:The content on the digital communication platform about the culture of Rizhao green tea meets my learning needs.	
Technology characteristics	tec1:The digital platform's sunshine green tea culture experience function facilitates my ability to share, discuss, and participate with others.	
	tec2:The viewing, interaction, and experience functions of this digital technology platform have well met my needs for understanding the culture of Rizhao green tea.	
	tec3:This digital platform can be easily accessed through various mobile devices to explore the cultural resources of Rizhao green tea.	
Cultural awareness	cua1:This digital experience has enhanced my sense of identity with the culture of Rizhao green tea.	
	cua2:This digital experience has sparked my interest in the culture of Rizhao green tea.	
	cua3:The cultural elements (stories, sound effects) in this experience can touch me and evoke emotional resonance.	
Improved tech-Task Fit	ttf1:In my opinion, the tea culture experience function of this digital platform is suitable for helping me complete my learning, research, and work tasks.	
	ttf2:In my opinion, the technological format of this digital platform is highly suitable for showcasing the cultural essence of Rizhao green tea.	
	ttf3:In my opinion, the tea culture experience function of this digital platform meets my requirements for understanding or research.	
Use intentions	ui1:I am curious about the tea culture experience offered by this digital platform.	
	ui2:I plan to use this digital platform for tea culture experience in the future.	
	ui3:I predict that in the future, people will use this digital platform for tea culture experience.	
Use behavior	ub1:Deciding to use this digital platform is a good idea.	
	ub2: Once I use this digital platform, I will continue to use it.	
	ub3:I am willing to recommend this digital tea culture experience to others.	
Peformance expectancy	pe1:Using this digital experience allows me to efficiently acquire knowledge about the culture of sunshine green tea regions.	[28]
	pe2:Using this digital technology has been very helpful for me to understand or appreciate the culture of Rizhao green tea.	
	pe3:Using this digital technology enables me to work more efficiently during the tea culture experience.	
	pe4:Using this digital technology has increased my chances of achieving my goals.	
Effort expectancy	ee1:Learning how to use this digital tea culture experience is easy for me.	
	ee2:I think the interface design of this digital tea culture experience is simple, clear, and easy to understand.	
	ee3:I think the interactive design of this digital tea culture experience is very smooth.	
	ee4:I can easily master and utilize this digital tea culture experience.	
Social influence	si1:The people who are important to me believe that I should use this digital technology to achieve my tea culture experience goal.	
	si2:The people who influence me believe that I should use this digital technology to achieve my tea culture experience goal.	
	SI3:Those who value my opinions believe that I should utilize this digital technology to achieve my tea culture experience goals.	
Facilitating condition	fc1:I possess the necessary resources to utilize this digital technology.	
	fc2:I possess the knowledge to utilize this digital technology.	
	fc3:This digital technology is compatible with other digital technologies I use for tea culture experience.	
	fc4:If I encounter difficulties while using this digital technology, I can get help from others.	

Descriptive analysis

A descriptive statistical analysis was conducted on the data, as presented in Table 3. The mean values ranged from 2.96 to 3.83, while the standard deviations ranged from 0.638 to 1.232. The skewness values ranged from − 0.517 to 0.059, and the kurtosis values ranged from − 0.955 to − 0.033. Because the absolute values of skewness are less than 3 and the absolute values of kurtosis are less than 10, the data are considered to satisfy the assumption of multivariate normal distribution, indicating that the dataset is suitable for subsequent statistical analyses.

Table 3
Descriptive analysis.

Variable	Measurement variable	Statistic	Min	Max	Average	Standard deviation	Skewness	Kurtosis
Task characteristics	tac1	1442	1	5	3.29	1.197	-0.303	-0.795
	tac2	1442	1	5	3.66	1.131	-0.517	-0.618
	tac3	1442	1	5	3.43	1.185	-0.399	-0.731
	tac4	1442	1	5	3.49	1.160	-0.465	-0.595
Technology characteristics	tec1	1442	1	5	3.24	1.145	-0.110	-0.860
	tec2	1442	1	5	3.33	1.121	-0.167	-0.824
	tec3	1442	1	5	3.04	1.147	-0.110	-0.844
Cultural awareness	cua1	1442	1	5	3.02	1.184	-0.016	-0.905
	cua2	1442	1	5	3.10	1.181	-0.030	-0.888
	cua3	1442	1	5	2.97	1.185	0.012	-0.880
Peformance Expectancy	pe1	1442	1	5	3.51	1.110	-0.391	-0.631
	pe2	1442	1	5	3.73	1.061	-0.484	-0.614
	pe3	1442	1	5	3.37	1.121	-0.404	-0.571
	pe4	1442	1	5	3.51	1.098	-0.443	-0.486
Effort expectancy	ee1	1442	1	5	3.14	1.212	-0.158	-0.926
	ee2	1442	1	5	3.39	1.209	-0.316	-0.813
	ee3	1442	1	5	3.30	1.214	-0.273	-0.852
	ee4	1442	1	5	3.10	1.232	-0.181	-0.955
Social influence	si1	1442	1	5	3.30	1.139	-0.286	-0.738
	si2	1442	1	5	3.35	1.135	-0.297	-0.753
	si3	1442	1	5	3.25	1.139	-0.229	-0.778
Facilitating condition	fc1	1442	1	5	2.96	1.197	-0.064	-0.916
	fc2	1442	1	5	3.29	1.207	-0.183	-0.944
	fc3	1442	1	5	3.13	1.194	-0.116	-0.871
	fc4	1442	1	5	3.15	1.178	-0.116	-0.855
Improved tech-Task Fit	ttf1	1442	1	5	2.96	0.720	-0.023	-0.033
	ttf2	1442	1	5	3.20	0.723	-0.023	-0.181
	ttf3	1442	2	5	3.36	0.648	0.059	-0.186
Use intentions	ui1	1442	1	5	3.55	0.721	-0.009	-0.210
	u2	1442	1	5	3.83	0.638	-0.145	0.118
	u3	1442	1	5	3.48	0.708	-0.035	-0.120
Use behavior	ub1	1442	1	5	3.50	0.707	-0.238	0.218
	ub2	1442	1	5	3.28	0.729	-0.107	-0.187
	ub3	1442	1	5	3.68	0.686	-0.313	0.512

Reliability analysis

As shown in Table 4, the Cronbach's alpha coefficients for the ten dimensions designed in this scale are all greater than 0.7, ranging from 0.785 to 0.903, indicating good internal consistency. Furthermore, the values of "Cronbach's alpha if item deleted" show no significant change compared with the overall Cronbach's alpha coefficients of the corresponding variables, suggesting that all items should be retained. In addition, the corrected item–total correlation (CITC) values are all greater than 0.5, indicating strong correlations between individual items and the overall scale. Overall, these results demonstrate that the

measurement scale used in this study exhibits high reliability, with all Cronbach's alpha values exceeding the recommended threshold of 0.7, making the data suitable for further analysis.

Table 4
Scale reliability statistics.

Variable	Measurement variable	The correlation between the corrected item and the total	Cronbach's Alpha after deleting items	Cronbach's Alpha
Task characteristics	tac1	0.664	0.766	0.822
	tac2	0.632	0.781	
	tac3	0.642	0.777	
	tac4	0.64	0.778	
Technology characteristics	tec1	0.753	0.831	0.875
	tec2	0.781	0.805	
	tec3	0.746	0.836	
Cultural awareness	cua1	0.672	0.764	0.824
	cua2	0.69	0.746	
	cua3	0.676	0.761	
Peformance expectancy	pe1	0.761	0.879	0.901
	pe2	0.818	0.859	
	pe3	0.79	0.869	
	pe4	0.75	0.883	
Effort expectancy	ee1	0.605	0.725	0.785
	ee2	0.581	0.738	
	ee3	0.594	0.731	
	ee4	0.584	0.736	
Social influence	si1	0.748	0.799	0.863
	si2	0.747	0.8	
	si3	0.723	0.823	
Facilitating condition	fc1	0.698	0.816	0.856
	fc2	0.73	0.803	
	fc3	0.679	0.824	
	fc4	0.686	0.822	
Improved tech-Task Fit	ttf1	0.801	0.867	0.903
	ttf2	0.83	0.841	
	ttf3	0.796	0.873	
Use intentions	ui1	0.816	0.836	0.897
	u2	0.777	0.872	
	u3	0.803	0.848	
Use behavior	ub1	0.722	0.761	0.84
	ub2	0.700	0.783	
	ub3	0.692	0.79	

Validity analysis

EFA

Validity primarily refers to assessing whether the questionnaire scale accurately and effectively measures the theoretical constructs proposed in the study. By testing the questionnaire scale, the results shown in Table 5 indicate that the Kaiser–Meyer–Olkin (KMO) value is 0.858, which is well above the recommended threshold of 0.6, suggesting that the research data are suitable for factor analysis. Additionally, the Bartlett's Test of Sphericity shows a

significance level (p-value) of 0.000, which is less than 0.01, indicating that the correlation matrix is not an identity matrix and that significant correlations exist among the variables. Therefore, the dataset is considered appropriate for conducting EFA.

Table 5
KMO and Bartlett inspection.

Bartlett's test of sphericity	**0.858**	
Bartlett's test of sphericity	Approximate chi-square	24631.495
	Degree of freedom	561
	Salience	0

The validity of the research model was further examined through EFA. Principal Component Analysis (PCA) was employed for factor extraction. As shown in Table 6, a total of 10 common factors with eigenvalues greater than 1 were extracted from 34 measurement items. The variance explained by the first factor was 20.256%, which is below the 40% threshold, indicating that no serious common method bias or multicollinearity issue exists. Furthermore, after factor rotation, the cumulative variance explained reached 74.255%, suggesting that the extracted factors adequately represent most of the information contained in the 34 observed variables, thereby demonstrating strong explanatory power.

Table 6
Total variance explanation rate.

Ingredient	Initial eigenvalue			Extract the sum of squared loads			Sum of squared rotational loads		
	Total	Variance percentage	Accumulated%	Total	Variance percentage	Accumulated%	Total	Variance percentage	Accumulated%
1	6.887	20.256	20.256	6.887	20.256	20.256	3.115	9.163	9.163
2	3.214	9.452	29.708	3.214	9.452	29.708	2.834	8.335	17.498
3	2.503	7.363	37.071	2.503	7.363	37.071	2.659	7.822	25.319
4	2.251	6.619	43.691	2.251	6.619	43.691	2.49	7.324	32.643
5	2.148	6.318	50.008	2.148	6.318	50.008	2.475	7.28	39.924
6	1.966	5.781	55.789	1.966	5.781	55.789	2.415	7.102	47.026
7	1.944	5.716	61.505	1.944	5.716	61.505	2.365	6.955	53.981
8	1.793	5.275	66.78	1.793	5.275	66.78	2.341	6.885	60.866
9	1.493	4.392	71.172	1.493	4.392	71.172	2.321	6.827	67.693
10	1.048	3.083	74.255	1.048	3.083	74.255	2.231	6.562	74.255
11	0.570	1.676	75.931						
12	0.549	1.615	77.547						
13	0.525	1.545	79.091						
14	0.490	1.44	80.532						
15	0.474	1.396	81.927						
16	0.464	1.365	83.292						
17	0.433	1.275	84.567						
18	0.406	1.194	85.761						
19	0.399	1.172	86.933						
20	0.390	1.147	88.080						
21	0.363	1.068	89.148						
22	0.353	1.038	90.187						
23	0.338	0.995	91.181						
24	0.334	0.983	92.165						
25	0.321	0.944	93.109						
26	0.311	0.914	94.023						
27	0.306	0.901	94.924						
28	0.291	0.854	95.778						
29	0.273	0.802	96.580						
30	0.254	0.747	97.327						
31	0.248	0.728	98.055						
32	0.239	0.703	98.758						
33	0.224	0.660	99.417						
34	0.198	0.583	100						

Factor rotation allows each variable to exhibit high loadings on a limited number of factors, while the loadings on other factors remain close to zero, resulting in a more concise structural pattern. This improves the interpretability of the model and facilitates identification of the underlying meaning of the extracted factors. In this study, the Varimax rotation method was applied to clarify the correspondence between the extracted factors and the measurement items. As presented in Table 7, all factor loadings exceed 0.5, indicating strong correlations between the factors and the corresponding items, and confirming that the factors effectively capture meaningful information.

Table 7
Rotation factor load matrix.

PE2	Ingredient1	Ingredient2	Ingredient3	Ingredient4	Ingredient5	Ingredient6	Ingredient7	Ingredient8	Ingredient9	Ingredient
	0.886									
PE3	0.865									
PE1	0.847									
PE4	0.845									
FC2		0.845								
FC1		0.822								
FC4		0.806								
FC3		0.8								
TAC1			0.814							
TAC3			0.789							
TAC4			0.787							
TAC2			0.775							
UI1				0.868						
UI3				0.857						
UI2				0.848						
EE4					0.775					
EE3					0.771					
EE1					0.767					
EE2					0.745					
TEC2						0.881				
TEC3						0.872				
TEC1						0.853				
SI1							0.872			
SI2							0.867			
SI3							0.854			
TTF2								0.837		
TTF3								0.833		
TTF1								0.81		
UB1									0.859	
UB3									0.847	
UB2									0.835	
CUA1										0.842
CUA2										0.84
CUA3										0.835

CFA

As shown in Table 8, the factor loadings of all items corresponding to the ten latent variables are greater than 0.70, indicating that the items exhibit strong representativeness for their respective constructs. The convergent validity of the model was evaluated using Composite Reliability (CR) and Average Variance Extracted (AVE). CR assesses the internal consistency and reliability of the latent constructs, while AVE measures the extent to which a latent variable explains its associated observed variables. Generally, CR values should be ≥ 0.7, and AVE values should exceed 0.5. According to Table 8, the CR values range from 0.838 to 0.912, and the AVE values range from 0.633 to 0.722. Both metrics exceed the recommended thresholds, indicating that the measurement model demonstrates strong convergent validity and that the latent variables reliably represent their respective observed variables.

Table 8
Factor loading.

Path	Estimate	AVE	CR
TAC4<---Task_Characteristics	0.727	0.536	0.822
TAC3<---Task_Characteristics	0.729		
TAC2<---Task_Characteristics	0.719		
TAC1<---Task_Characteristics	0.753		
CUA3<---Cultural_Awareness	0.776	0.610	0.824
CUA2<---Cultural_Awareness	0.802		
CUA1<---Cultural_Awareness	0.764		
PE4<---Peformance_Expectancy	0.799	0.698	0.902
PE3<---Peformance_Expectancy	0.847		
PE2<---Peformance_Expectancy	0.88		
PE1<---Peformance_Expectancy	0.813		
EE4<---Effort_Expectancy	0.672	0.477	0.785
EE3<---Effort_Expectancy	0.692		
EE2<---Effort_Expectancy	0.684		
EE1<---Effort_Expectancy	0.715		
SI3<---Social_Influence	0.799	0.678	0.863
SI2<---Social_Influence	0.836		
SI1<---Social_Influence	0.835		
FC3<---Facilitating_Condition	0.75	0.598	0.856
FC2<---Facilitating_Condition	0.811		
FC1<---Facilitating_Condition	0.771		
FC4<---Facilitating_Condition	0.76		
TTF1<---Improved_TechTaskFit	0.864	0.759	0.904
TTF2<---Improved_TechTaskFit	0.898		
TTF3<---Improved_TechTaskFit	0.851		
UI1<---Use_Intentions	0.885	0.746	0.898
UI2<---Use_Intentions	0.835		
UI3<---Use_Intentions	0.871		
UB3<---Use_Behavior	0.778	0.638	0.841
UB2<---Use_Behavior	0.798		
UB1<---Use_Behavior	0.82		
TEC3<---Technology_Characteristics	0.814	0.702	0.876
TEC2<---Technology_Characteristics	0.866		
TEC1<---Technology_Characteristics	0.832		

According to Fornell and Larcker's (1981) criteria, a construct demonstrates discriminant validity if the square root of its AVE is greater than its correlation coefficients with other constructs. This principle ensures that each latent variable explains more variance in its own indicators than it shares with other variables. As shown in Table 9, the square root of the AVE for each variable exceeds its Pearson correlation coefficients with all other variables, indicating that the measurement model possesses good discriminant validity and that each construct is empirically distinct from the others.

Table 9
Inter item correlation matrix.

TAC	TAC	TEC	CUA	TTF	PE	EE	SI	FC	UI	UB
	0.732									
TEC	0.025***	**0.838**								
CUA	0.026***	0.028***	**0.781**							
TTF	0.017***	0.019***	0.019***	**0.871**						
PE	0.023***	0.025***	0.026***	0.017***	**0.835**					
EE	0.024***	0.025***	0.026***	0.017***	0.024***	**0.691**				
SI	0.025***	0.026***	0.027***	0.018***	0.024***	0.025***	**0.823**			
FC	0.025***	0.027***	0.027***	0.018***	0.024***	0.025***	0.026***	**0.773**		
UI	0.017***	0.018***	0.018***	0.013***	0.017***	0.017***	0.018***	0.017***	**0.864**	
UB	0.014	0.015	0.016	0.011***	0.014	0.014	0.015***	0.015	0.012***	**0.799**
Note: The diagonal black bold numbers represent the square root of AVE, * * * represents p < 0.01										

Structural model

Model fit

As presented in Table 10, several indices were used to evaluate the goodness-of-fit of the SEM. The chi-square to degrees of freedom ratio (CMIN/DF) is 1.083, which falls within the acceptable range of 1–3, indicating a good model fit. The RMSEA and RMR values are 0.008 and 0.021, respectively, both below the 0.05 threshold, reflecting excellent model adaptability. Other fit indices, including GFI (0.979), AGFI (0.975), CFI (0.998), RFI (0.976), and TLI (0.998), all exceed the recommended threshold of 0.90, further confirming the model's suitability. In summary, all fit indices meet the reference standards, demonstrating that the structural model exhibits strong overall fit. The final model is illustrated in Fig. 2.

Table 10
Model fitting coefficients.

Test indicator	CMIN/DF	RMSEA	RMR	GFI	AGFI	CFI	RFI	TLI
Reference standard	1 ~ 3	<0.05	<0.05	>0.90	>0.90	>0.90	>0.90	>0.90
Model fit	1.083	0.008	0.021	0.979	0.975	0.998	0.976	0.998

Path analysis

The p-values were used to evaluate the path coefficients between variables, thereby testing the proposed hypotheses. A path is considered statistically significant when $p < 0.05$. As shown in Table 11, all hypothesized paths were supported. Within the improved TTF model, TAC significantly influenced TTF ($\beta = 0.141$, $p < 0.001$), supporting H1, while TEC also had a significant effect on TTF ($\beta = 0.248$, $p < 0.001$), supporting H2. In addition, CUA had a significant positive effect on TTF ($\beta = 0.135$, $p < 0.001$), supporting H9. Within the UTAUT model, PE ($\beta = 0.096$, $p < 0.001$), Effort Expectation (EE) ($\beta = 0.079$, $p = 0.008$), SI ($\beta = 0.176$, $p < 0.001$), and FC ($\beta = 0.103$, $p < 0.001$) all had significant positive effects, supporting H4, H5, H6, and H7, respectively. Moreover, TTF had a significant impact on UI ($\beta = 0.522$, $p < 0.001$), supporting H3, and UI significantly influenced UB ($\beta = 0.503$, $p < 0.001$), supporting H8. The finalized structural model, including all significant paths, is illustrated in Fig. 2.

Table 11
Assumption result of path coefficient.

Route	Unstandardized coefficient	Standardized coefficient	S.E.	C.R.	P	Results
Improved_TechTaskFit <--- Task_Characteristics	0.104	0.141	0.021	4.883	***	support
Improved_TechTaskFit <--- Technology_Characteristics	0.165	0.248	0.019	8.859	***	support
Improved_TechTaskFit <--- Cultural_Awareness	0.091	0.135	0.019	4.69	***	support
Improved_TechTaskFit <--- Peformance_Expectancy	0.068	0.096	0.019	3.536	***	support
Improved_TechTaskFit <--- Effort_Expectancy	0.059	0.079	0.022	2.656	0.008	support
Improved_TechTaskFit <--- Social_Influence	0.12	0.176	0.019	6.311	***	support
Improved_TechTaskFit <--- Facilitating_Condition	0.072	0.103	0.02	3.67	***	support
Use_Intentions <--- Improved_TechTaskFit	0.536	0.522	0.028	18.983	***	support
Use_Behavior <--- Use_Intentions	0.42	0.503	0.025	16.76	***	support
Note: * * *: $p < 0.001$						

Result

This study employed SEM to analyze the overall dataset and test the proposed hypotheses (H1–H9). All nine hypotheses were supported by the analysis. The hypotheses are summarized as follows H1: The TAC of leisure experience and learning sharing on digital media platforms have a positive effect on TTF. H2: The ease of operation of digital media platforms and the TEC of creative interactivity positively influence TTF. H3: TTF has a positive effect on UI. H4: PE positively impacts TTF. H5: EE positively affects TTF. H6: SI positively affects TTF. H7: FC) including platforms, devices, smartphones, policies, social media networks, resource and funding allocation, and knowledge and training, positively influence TTF. H8: UI positively affects UB. H9: CUA positively affects TTF. The detailed results and standardized path coefficients of the SEM analysis are illustrated in Fig. 3.

Discuss

This study provides recommendations for the dissemination of RZT cultural heritage based on an improved TTF–UTAUT model, analyzing tourists' UI digital media technology platforms and exploring the mechanisms through which RZT serves as a dissemination pathway for rural cultural heritage in Rizhao, China. The aim is to address the challenges identified in the study and fill the research gap regarding the dissemination pathways of RZT culture. According to the results of the SEM, all hypothesized paths were supported and met the study criteria. With respect to the research questions (RQ1–RQ3): RQ1: H1, H2, H3, and H9 directly address how TAC, technology characteristics, TTF, and CUA influence tourists' willingness to act as disseminators of RZT culture. RQ2: H4–H7 indirectly affect UI through the mediating role of TTF, which subsequently influences UB, thereby addressing the impact of PE, EE, SI, and FC. RQ3: H3 and H8 directly address the mediating and moderating effects of UI on UB, illustrating the pathway mechanism of RZT cultural dissemination.

TTF has a positive impact on usage intention (social media platforms)

The results indicate that TAC and TEC in the improved TTF model have a significant impact on TTF, supporting H1 and H2. As disseminators of RZT cultural heritage, tourists' TAC primarily encompass immersive experiences, learning tea culture knowledge, leisure and entertainment, social sharing, and alignment with the needs of digital media communication platforms. These TAC enhance the overall fit between tourists' tasks and the technology. TEC, on the other hand, refers to the functional attributes of existing or optional communication technologies, including high-quality visual and audio effects, narrative capabilities, ease of operation and feedback, interactive creation features, accessible hardware, and network conditions and costs. These technical features directly influence the usability and experiential quality for tourists acting as RZT cultural communicators. When the technical features of digital media platforms align well with tourists' task requirements, a higher degree of TTF is achieved, resulting in greater user satisfaction and enjoyment during the dissemination process.

The inclusion of CUA in the TTF model has a significant positive impact on TTF, supporting H9. The findings indicate that when digital technology platforms convey a meaningful cultural heritage connotation, tourist users transition from being mere tool users to active cultural participants and disseminators. This transformation occurs because features such as visual storytelling and note-sharing functions on short video platforms align closely with the knowledge transmission and emotional engagement tasks of RZT cultural heritage dissemination. By enhancing users' perception of the cultural value of RZT, these platforms not only facilitate the effectiveness of cultural inheritance and evaluation but also strengthen users' cognitive recognition of cultural identity. This heightened CUA, in turn, increases users' engagement and willingness to participate in the dissemination process, ultimately promoting more active and sustained dissemination behavior through digital media platforms.

The TTF in this study has a significant positive effect on UI, supporting H3. For tourists, TTF enhances their willingness to act as disseminators through a dual pathway of experiential satisfaction and social value creation. When the technical features of digital technology platforms, such as short videos, LBS check-ins, and topic tagging, are well-aligned with these tasks, TTF is strongly reinforced, which in turn promotes tourists' sustained engagement and UB.

In summary, the improvement of the TTF model represents a key innovation of this study. In the dissemination of RZT cultural heritage via digital media platforms, it is essential not only to optimize the platform's inherent technical functions but also to coordinate these functions with users' task requirements while maintaining operational simplicity. Simultaneously, the cultural characteristics of RZT must be integrated to enhance tourists' UI digital media platforms as active disseminators, effectively addressing RQ1.

UTAUT has a positive impact on usage intention (social media platforms)

The H4–H7 pathway analysis demonstrates that the four core variables of the UTAUT model, PE, EE, SI, and FC, exert a positive indirect effect on users' UI through the mediating role of TTF. This approach extends the traditional UTAUT framework by integrating the TTF perspective, representing a novel contribution and an innovation of this study.

PE has a positive effect on TTF and indirectly influences UI, supporting H4. When tourists engage in promoting RZT cultural heritage, if they perceive that digital media platforms can efficiently showcase the tea mountain scenery, vividly narrate tea-making stories, and accurately reach interested audiences, they form a cognitive judgment that the platform is well-suited for promoting RZT culture. This alignment between task requirements and technological capabilities ultimately drives tourists' UI social media platforms for dissemination.

EE is positively correlated with TTF and indirectly affects UI, supporting H5. For tourists, the dissemination of RZT cultural heritage often emphasizes immediacy and fragmentation. When digital media platforms are easy to operate and technically capable, tourists can quickly identify and engage in scenarios suitable for instant dissemination and sharing, enhancing their UI these platforms. Thus, the principle that lower effort leads to higher TTF can indirectly strengthen tourists' UI for spreading RZT cultural heritage.

SI significantly impacts TTF and indirectly affects UI, supporting H6. The effect of SI on UI depends on tourists' pre-existing perception of the TTF of the digital platform. For example, if a platform is already perceived as highly suitable for disseminating RZT culture, recommendations or endorsements from peers, influencers, or cultural authorities serve as a form of dual validation, further enhancing TTF and increasing tourists' UI the platform.

FC positively influence TTF and indirectly affect UI, supporting H7. When tourists have access to a reliable network environment, compatible smart devices, technical support, and policy or funding backing from local authorities in Rizhao, the criteria for evaluating their competence in disseminating RZT culture become clearer. Technology previously deemed unsuitable due to resource constraints can, under favorable enabling conditions, be redefined as adaptive, further enhancing TTF and UI.

In summary, the four core variables of the UTAUT model, PE, EE, SI, and FC, exert a positive indirect influence on UI through TTF. The adoption of digital media platforms by tourists is not a simple linear process but a cognitive progression from resource empowerment to task-technology alignment, ultimately leading to willingness conversion. This framework provides a new perspective for optimizing the dissemination of RZT cultural heritage and effectively addresses RQ2.

The willingness to use social media platforms has a positive impact on usage behavior

UI has a positive effect on UB, supporting H8. Specifically, when tourists develop a clear intention to actively create RZT cultural content, participate in topic check-ins, and share immersive experiences via social media platforms, this intention translates into concrete behaviors such as posting, liking, commenting, and forwarding. In the context of this study, the low barrier and high immediacy of such actions, like casual filming or on-site QR code scanning during travel, facilitate a smooth conversion from intention to behavior. Consequently, UI serves as a mediating mechanism, linking the improved TTF model to actual dissemination behavior and effectively addressing RQ3.

Conclusion

This study examines the digital platform dissemination of RZT rural cultural heritage and constructs a cultural dissemination mechanism model based on the integration of TTF and UTAUT models. The study aims to clarify the formation pathways and key driving factors underlying tourist participation in RZT cultural dissemination on social media platforms. The results indicate that the TAC of leisure experience and learning sharing, as well as the TEC of simple operability and creative interactivity, positively influence TTF, thereby promoting users' dissemination behaviors and UI. CUA further enhances this process: when users identify with the historical evolution and production techniques of RZT, they develop a sense of responsibility for its dissemination. High alignment with TTF encourages users to actively share and promote RZT culture. Additionally, PE and EE indirectly drive UI through TTF, SI is positively moderated by TTF, and FC serve as enabling factors that strengthen the effect of TTF on UI. This process activates tourists' deep perception of the cultural value embedded in TTF, facilitating the transformation from passive information replicators to active cultural inheritors, and converting UB into meaningful co-creation practices for cultural heritage dissemination. Overall, this study provides a macro-level perspective on symbol dissemination and social reconstruction in the context of digital cultural heritage. The main contribution lies in expanding the TTF and UTAUT models through the improved TTF-UTAUT framework to analyze the dissemination pathways of RZT cultural heritage, offering practical references and novel ideas for promoting Chinese rural cultural heritage. Finally, it is important to note that the study has limitations in sample representativeness due to temporal and spatial constraints, which should be addressed in future research.

Declarations

Author Contributions

Conceptualization, Z.Z., G.L., L.Y. and C.L.; methodology, Z.Z., G.L.; software, Z.Z. G.L.; validation, Z.Z., G.L. and L.Y.; formal analysis, Z.Z. C.L.; investigation, Z.Z. and G.L.; resources, L.Y.; data curation, Z.Z. and G.L.; writing—original draft preparation, Z.Z.; writing—review and editing, G.L.; visualization, Z.Z. and G.L.; supervision, L.Y.; project administration, Z.Z., G.L.; funding acquisition, Z.Z.;All authors have read and agreed to the published version of the manuscript.

Institutional Review Board Statement

This study was conducted in accordance with the Helsinki Declaration and was approved by the Committee on Bioethics and Medical Ethics of Dalian University of Technology on April 23, 2026 (Acceptance Number: 2026262; Approval Number: DUTSAFA260423-01).

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NO

Informed Consent Statement

Due to the questionnaire not covering sensitive topics and emphasizing user privacy, anonymous data collection was used, and verbal informed consent was obtained from all the participants.

Data Availability Statement

The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

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Figures

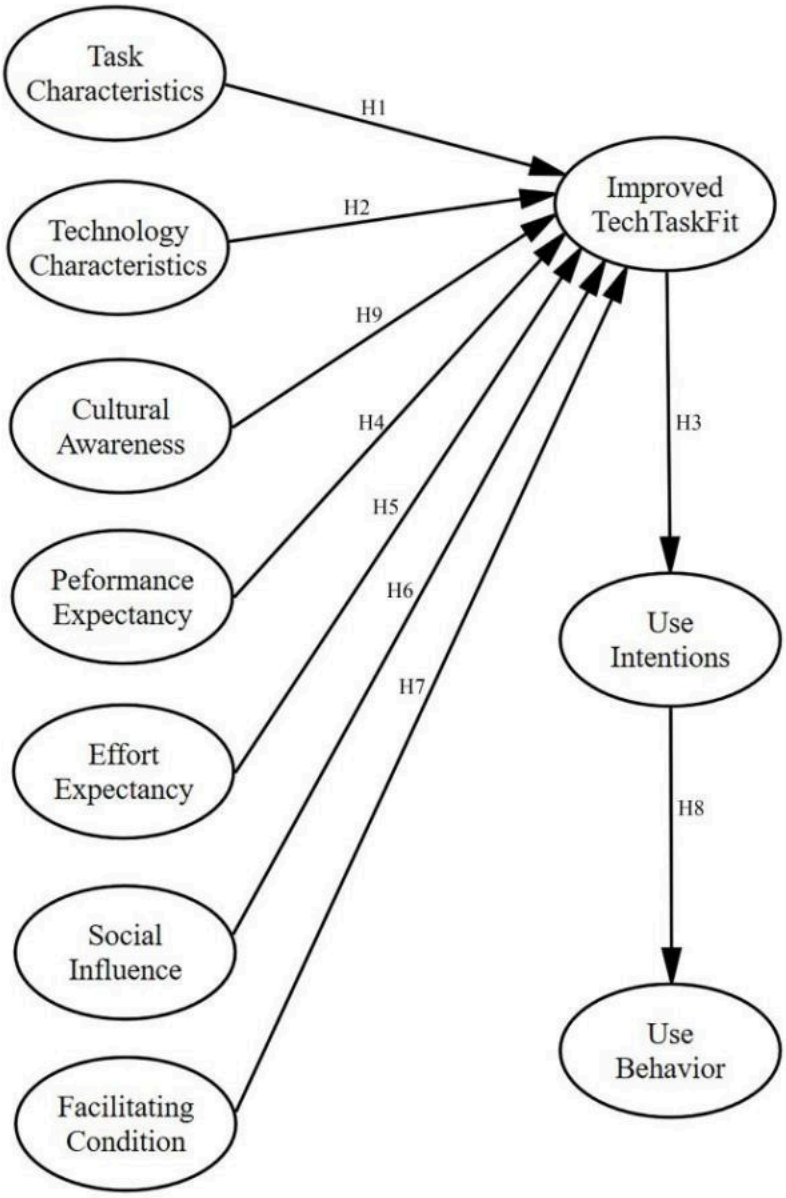


Figure 1

Research model.

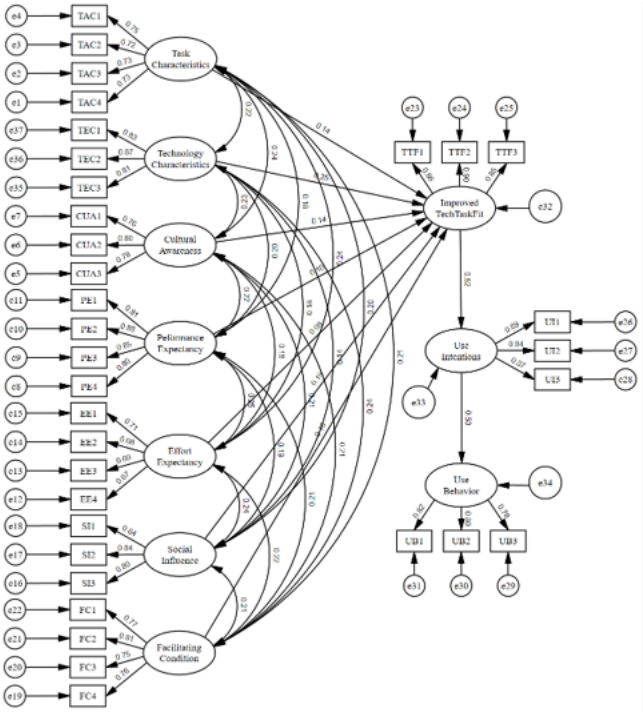


Figure 2

Standardized path coefficient structural equation model.

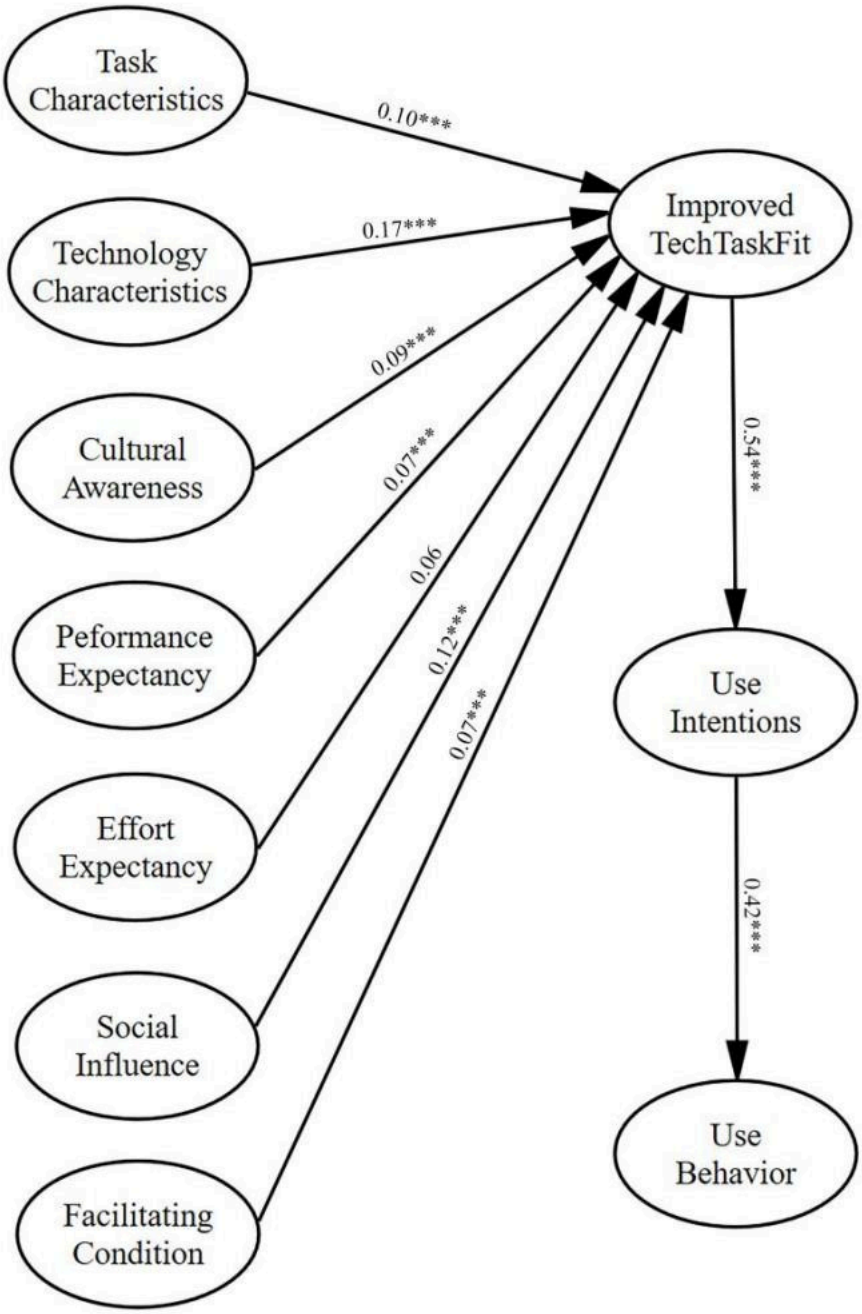


Figure 3

Model result diagram.