# Research on Tourist Acceptance of the Digital Service Model for High-Altitude Mountain Tourism Equipment: a Case Study of a Plateau Scenic Area

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**Abstract: High-altitude hypoxia and network dead zones constrain the development of traditional smart tourism.Based on an extended UTAUT model, this study introduces the variables of perceived risk and service resilience to conduct an empirical analysis of a plateau scenic area. However, the significant findings may suggest that tourists are willing to use digital equipment primarily because they value its usefulness and safety, while equipment usability under extreme environmental conditions could indicate the fundamental challenge. Furthermore, the results may demonstrate that social media and word-of-mouth can rapidly disseminate information, increasing the willingness to use digital equipment. Given that the evidence shows contrasting tendencies between ordinary tourists and professional mountaineers, these opposing patterns might indicate that the overall effect of ease of operation appears less pronounced. Service resilience shows offline usability and cold resistance alleviate risk anxiety. In light of these significant findings, the study proposes a dual-track model of "online platform supervision + offline outlet manual services" to support safe operations in the scenic area.**

**Keywords: Plateau Scenic Areas; Digital Service Model; UTAUT Model; Tourist Acceptance**

## 1. Introduction and Theoretical Foundation

The core barriers to widespread adoption of smart tourism in high-altitude mountainous areas could indicate that physical constraints from extreme geographical conditions (hypoxia, network dead zones, severe cold) on digital service systems, as well as the resulting safety anxiety among tourists, may represent the fundamental challenges. Moreover, the study may suggest that addressing these key challenges in the popularization of smart tourism in mountainous regions requires an extended theoretical framework. Therefore, based on Service-Dominant Logic, the study introduces an extended Unified Theory of Acceptance and Use of Technology (UTAUT) model and might demonstrate that innovatively incorporating "digital service resilience" as a risk-mitigation variable into the analytical framework appears important. Research shows technological obstacles in high-altitude environments provide theoretical support for safe operation of scenic areas and digital transformation of mountain tourism.

## 2. Research Design and Methods

Notwithstanding the broader context of mountain tourism research, the study selects a plateau scenic area in Aba Prefecture, Sichuan Province, as a typical case study, and the significant findings may suggest that this scenic area features a composite business model accommodating both general sightseeing and professional outdoor mountaineering activities. Additionally, the key characteristics could demonstrate that a large altitude span, variable climate, severe cold, and weak or completely disconnected mobile communication signals across extensive areas appear to pose challenges to battery life and network connectivity of traditional digital devices. Thus, the evidence may indicate that the composite features of this scenic area in terms of space, environment, and tourist segmentation might demonstrate that it appears highly representative for exploring adoption willingness and model construction of digital services. Study shows area suits high-altitude tourism equipment research.

### 2.1 Questionnaire Design and Data Sources

This study employs a questionnaire survey to obtain quantitative data. The questionnaire is structured into two parts: the first part collects tourists' demographic characteristics and on-site outdoor behaviors; the second part corresponds to the six latent variable scales of the extended UTAUT model.(1) Performance Expectancy (PE):measured by real-time vital sign monitoring, one-touch SOS in network dead zones, and the high safety protection value of digital equipment; (2) Effort Expectancy (EE):measured by minimalist interface interaction, ease of fine motor control while wearing thick gloves, and willingness to tolerate cumbersome operations to ensure safety; (3) Social Influence (SI):measured by social media guides, advice from fellow hikers and guides, and word-of-mouth promotion; (4) Perceived Risk of Plateau Environment (PR): measured by equipment shutdown due to low temperature, loss of contact due to weak network connectivity in blind spots, and equipment hardware/software failure threatening life; (5) Digital Service Resilience (SR): measured by offline usability, environmental cold resistance, and system recoverability; (6) Behavioral Intention (BI):measured by willingness to actively rent, willingness to recommend to fellow hikers or friends, and willingness to prioritize [the equipment] when visiting similar high-altitude scenic areas in the future. Except for demographic characteristics, all other items are measured using a Likert 5-point scale. The survey was conducted primarily in the first quarter of 2026, employing on-site interception survey at the tourist center of a plateau scenic area in Sichuan Province, along with targeted distribution through online outdoor mountaineering communities. A total of 252 valid questionnaires were collected, with an effective response rate of 84.0%. The sample size fully meets the robustness requirements for large-sample statistical analysis.

## 2.2. Sample Characteristics Description

Among the 252 valid samples, males accounted for 54.8% and females for 45.2%, with the young and middle-aged group aged 18-35 accounting for 71.4%. In terms of visitor types, the sample exhibits good heterogeneity: "general sightseeing and light hiking" tourists accounted for 63.9% (161 individuals); "professional mountaineering and heavy outdoor equipment users" accounted for 36.1% (91 individuals). Furthermore, statistics on the incidence of environmental risks indicate that 42.1% of respondents confirmed experiencing a complete loss of mobile signal deep in the core tour routes, and 12.3% of tourists experienced sudden device shutdowns due to severe cold and low temperatures, providing solid factual data for the environmental risk variables. Descriptive statistics for the latent variables were calculated using SPSS 26.0. To clarify group differences at the outset of the empirical analysis, the study split and compared the samples between general tourists and professional tourists. The descriptive statistical results for all measurement items are shown in Table 1.

**Table 1. Comparative Descriptive Statistics of Latent Variable Dimensions by Tourist Subgroup (N=252)**

| Latent Variable Dimension | Mean (General Tourists) | Mean (Professional Tourist ) | SD |
|---|---|---|---|
| PE | 4.05 | 4.52 | 0.65 |
| EE | 2.45 | 4.31 | 1.18 |
| SI | 3.92 | 3.71 | 0.72 |
| PR | 4.38 | 4.48 | 0.58 |
| SR | 4.12 | 4.26 | 0.61 |
| BI | 3.82 | 4.62 | 0.67 |

Based on the statistical data in Table 1, it can be observed that the score distribution and group differences across dimensions profoundly reflect the unique characteristics of high-altitude mountain tourism. First, the Perceived Risk of the Plateau Environment (PR) dimension exhibits the smallest overall standard deviation (0.58) in the entire table, and the subgroup means of the two groups of respondents are very close (4.38 vs. 4.48). This high degree of data consistency indicates that, regardless of the tourist segment, whether smart equipment can function properly in extreme environments has become a fundamental challenge hindering the popularization of smart mountain tourism. Second, Notwithstanding the importance of perceived risk findings, the evidence may suggest that the Effort Expectancy (EE) dimension shows the most pronounced dispersion in the entire table, with an overall standard deviation as high as 1.18. Results show general tourists scored only 2.45 due to hypoxia-induced dizziness and glove-related operational inconvenience, while professional mountaineers scored 4.31, demonstrating high tolerance for operational complexity for safety reasons, with these opposing tendencies explaining the high variability in this dimension.

## 3. Empirical Analysis and Results

### 3.1 UTAUT Model Path Hypothesis Testing and Findings

The study uses AMOS 26.0 to establish a Structural Equation Model (SEM) and performed full path estimation. The overall model fit indices were as follows: Chi-square/df ratio of 1.842, RMSEA of 0.058, CFI of 0.924, and TLI of 0.911, indicating that the theoretical model can effectively explain the true logical structure of the data. The specific results of the path tests are shown in Table 2.

**Table 2. Extended UTAUT Model Paths Hypothesis Estimation Results**

| Hypothesized Paths | β | Standard Error | Critical Ratio | P-value |
|---|---|---|---|---|
| H1: PE → BI | 0.284 | 0.083 | 3.422 | <0.001 |
| H2:SI→ BI | 0.176 | 0.079 | 2.228 | 0.026 |
| H3: PR → BI | -0.382 | 0.093 | -4.108 | <0.001 |
| H4: EE → BI | 0.138 | 0.068 | 2.029 | 0.042 |

Based on the model estimation results in Table 2,Performance Expectancy and Social Influence exert a significant positive influence on Behavioral Intention, indicating that the perceived usefulness and safety assurance of smart devices, along with word-of-mouth communication through social media, positively promote the willingness to use digital equipment. Notably, the absolute value of the negative path coefficient of Perceived Risk of the Plateau Environment on Behavioral Intention is the highest among all paths in the full model (β = -0.382), strongly demonstrating that tourists' psychological fear of smart devices failing to operate properly due to severe cold and network dead zones is the most critical constraint, and technological reliability is the primary barrier hindering the popularization of smart tourism. Furthermore, the path coefficient of Effort Expectancy on Behavioral Intention is marginally significant (β = 0.138, P = 0.042). This atypical statistical result perfectly captures the aforementioned cross-offsetting effect of group psychology. It is precisely because general tourists exhibit resistance to the complex operation of smart devices, while professional mountaineers demonstrate a certain tolerance for such complexity to ensure adequate safety, that the overall effect is diluted. Due to the differing feedback from the two groups on the same path, the overall effect in the full model only reaches marginal significance.

### 3.2 Verification of the Moderating Effect of Digital Service Resilience

To explore the intervention mechanism for mitigating the environmental risk challenges and the operational threshold for different groups, Model 1 introduced only basic tourist characteristics as control variables; Model 2 introduced the independent variable (Perceived Risk of the Plateau Environment) and the moderating variable (Digital Service Resilience); Model 3 formally incorporated the interaction term (Perceived Risk of the Plateau Environment PR × Digital Service Resilience SR) for hierarchical regression analysis. The specific results are shown in Table 3.

**Table 3. Hierarchical Regression Results of the Moderating Effect of Digital Service Resilience(N=252)**

| Variables and Model Fit Indices | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Visitor Type | $0.124^{*}$ | 0.088 | 0.076 |
| PR | | $-0.354^{***}$ | $-0.312^{***}$ |
| SR | | $0.215^{**}$ | $0.198^{**}$ |
| PR×SR | | | $0.142^{*}$ |
| $R^2$ / Adjusted $R^2$ | 0.024/0.012 | 0.245/0.229 | 0.268/0.250 |
| $\Delta R^2$ / F-value | 0.024/2.024 | $0.221^{***}$/15.984$^{***}$ | $0.023^{*}$/14.882$^{***}$ |

Note: *, **, and *** indicate statistical significance at the 0.05, 0.01, and 0.001 levels, respectively.

Based on the hierarchical regression results, the significant findings could indicate that the moderating effect of service resilience is mathematically valid, and the key data from Model 2 may suggest that Digital Service Resilience (SR) exerts a direct positive effect on Behavioral Intention (β = 0.215, P < 0.01). Additionally, the evidence appears to demonstrate that tourist acceptance is higher when digital equipment itself possesses foundational resilience guarantees, such as offline usability, cold resistance, long battery life, and automatic system fault recovery. Notwithstanding these results, after introducing the interaction term in Model 3, the significant findings might indicate that its coefficient is 0.142 and could pass the significance test (P=0.032<0.05), demonstrating that simply promoting unmanned smart solutions is insufficient for digital devices in high-altitude scenic areas to be adopted by tourists. Data show addressing operational and environmental conditions under which smart devices are used helps alleviate tourist fears. Therefore, the significant results could suggest that helping tourists feel confident enough to embrace these services appears to be the primary objective, which may demonstrate that resilience-focused design is the key intervention for adoption under extreme environmental conditions.

To more intuitively demonstrate the specific differences in how environmental risk affects tourist willingness under different levels of service resilience, the study further conducts a simple slopes test. However, the important findings may indicate that under conditions of low digital service resilience (i.e., Mean minus one standard deviation, Mean － 1SD), the negative inhibitory slope of Perceived Risk of the Plateau Environment on tourist Behavioral Intention could demonstrate a very steep trajectory, with a simple slope coefficient of $\beta = -0.454$ ($t = -4.892$, $P < 0.001$). Moreover, the significant evidence could suggest that if a scenic area rigidly pursues a fully smart, unmanned self-service route-where devices frequently shut down due to freezing in severe cold conditions without remedial solutions-tourists' fear of environmental risks might demonstrate immediate amplification, making them unwilling to accept smart service equipment. Given that the key results appear to demonstrate that high digital service resilience (i.e., Mean plus one standard deviation, Mean＋1SD) substantially alters this dynamic, the evidence may indicate that the negative inhibitory slope becomes significantly flatter, with a slope coefficient of $\beta = -0.170$ ($t = -1.984$, $P = 0.046 < 0.05$). This indicates that when a scenic area is well-prepared-equipped with high-altitude offline maps and satellite short message communication at the basic level, and when on-site service outlets provide manual guidance on minimalist unboxing and one-touch SOS procedures-although the natural dangers of the plateau still objectively exist, tourists' psychological defenses do not break down, and they remain confident in using smart service equipment.

## 4. Design and Optimization Path of the Digital Service Model for Tourism Equipment

Based on the preceding empirical research, in terms of hardware configuration, to address the risks of severe cold and network dead zones, scenic areas should prioritize deploying smart badges that integrate BeiDou short-message communication, dual-mode positioning, and vital sign monitoring, comprehensively upgrade low-temperature-resistant batteries, and achieve offline usability in completely disconnected network environments through pre-loaded full-area 3D terrain caching. In terms of service implementation, given the sharp divergence in operational thresholds between general sightseeing tourists and professional mountaineers, scenic areas should completely abandon a one-size-fits-all, impersonal digital instruction approach. Instead, they should innovatively establish a dual-track service model of "online platform supervision + offline outlet manual services." On one hand, relying on a big data center, the model enables full-area trajectory and vital sign monitoring for professional tourist groups, maximizing core safety precautions. On the other hand, to address the operational resistance of general tourists in harsh environments, staff at rental outlets provide face-to-face, minimalist manual demonstrations. This resilience compensation through manual processes actively lowers the operational threshold of equipment, achieving a flexible and robust delivery of digital services.

## 5. Conclusion

The empirical results could suggest that equipment reliability and safety assurance in severe cold and dead-zone environments appear to be the core challenges for the popularization of smart tourism, while the significant findings may indicate that social influence and word-of-mouth play a key facilitating role. Results show different tourist groups exhibit varying receptiveness to smart device operation.Therefore, scenic areas should move away from the unmanned self-service model. They should upgrade low-temperature resistance and offline usability technologies, while complementing these efforts with manual demonstrations at offline outlets. This will enable the construction of a dual-track resilience model of "online platform supervision + offline outlet manual services."

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