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International Leisure Tourist Satisfaction through Service Quality, Destination Cultural Inclusiveness and AI-Enabled Tourism Services: A PLS-SEM Analysis

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ABSTRACT
Saudi Arabia's rapid opening to international leisure tourism raises the question of what drives the satisfaction of visitors in a destination that is new to them. Grounded in SERVQUAL, expectancy–disconfirmation and cultural-adaptation perspectives, this study examined whether service quality and destination cultural adaptability shape optimum tourist satisfaction, and whether technology integration moderates these relationships. An online survey of 313 eligible international leisure tourists was analysed in two stages: SPSS for data screening and descriptive analysis, and higher-order partial least squares structural equation modelling (PLS-SEM) in SmartPLS with 5,000 bootstrap subsamples. Service quality (β = .451) and cultural adaptability (β = .457) each increased satisfaction, jointly explaining 80.6% of its variance. Reliability, inclusiveness and openness, and intercultural communication were the only dimensions with unique effects. Digital readiness (β = .327) and artificial intelligence applications (β = .251) also increased satisfaction, and technology integration was the strongest predictor (β = .817). Model fit was good (SRMR = .020–.033), but technology integration did not moderate either relationship. Respondents barely distinguished service quality from cultural adaptability, which suggests that visitors evaluate culturally adapted service as one experience. Dependable service, a welcoming intercultural climate and a seamless digital journey therefore act as parallel routes to satisfaction, with implications for Vision 2030 destination management.
Keywords: tourist satisfaction, service quality, cultural adaptability, smart tourism technology, PLS-SEM, Saudi Arabia

1.INTRODUCTION

Few destinations have changed their tourism model as quickly as Saudi Arabia. For decades, inbound travel to the Kingdom was dominated by Hajj and Umrah pilgrims, and tourism's contribution to the national economy depended largely on religious flows (Ali, 2018; Ali & Salameh, 2021). Under Vision 2030, the introduction of tourist e-visas in 2019, large-scale projects in AlUla and the Red Sea region, and heavy investment in infrastructure have repositioned the country as a leisure and cultural destination for non-religious international visitors (Qurtuby, 2024; Ibrahim, 2025). This transition has made the satisfaction of international leisure tourists a strategic concern. These visitors can choose among many mature destinations, compare their experience against international service benchmarks, and often arrive with uncertainty about local norms (Memish et al., 2023; Alshammari et al., 2023).

Tourist satisfaction has long been explained through service quality, most commonly operationalised through the SERVQUAL dimensions of tangibles, reliability, responsiveness, assurance and empathy (Parasuraman et al., 1988, 1991). Empirical support for the service quality–satisfaction link is broad (Eviana, 2024; Nian et al., 2024; Liu et al., 2025), but it is not uniform. Different dimensions matter in different settings (Kong et al., 2025), and some well-designed studies find no direct effect once other experiential factors are modelled (Renganathan et al., 2025). Two further streams have grown alongside this work. The first concerns cultural adaptability: the extent to which a destination communicates across cultures, welcomes diverse visitors and acts responsibly. Research shows that successful cultural adjustment raises satisfaction, especially in Muslim-majority destinations visited by Western tourists (Garrod & Nicholls, 2022; Roodhi et al., 2025). The second concerns smart tourism technology, where digital infrastructure, artificial intelligence (AI) and contactless services have been linked to satisfaction and revisit intention (Pai et al., 2020; Say, 2025; Chiengkul et al., 2025).

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These three streams have largely developed separately, using different theories, measures and samples (Zhang et al., 2025). In reality, international tourists meet service providers, the host culture and digital systems at the same time, and one weak element can undermine an otherwise strong experience. A reliable service delivered without cultural guidance, or an efficient digital platform that feels impersonal, may still fall short of delight. It is also unclear whether technology simply adds to satisfaction or whether it strengthens the effects of service and cultural factors, as the moderation literature suggests (Goo et al., 2022; Shin et al., 2021). The Saudi evidence base is thin on this question. Existing studies focus mainly on macroeconomic performance, policy and pilgrimage (Elkalawy et al., 2025; Elgzoli, 2024), or examine technology at the stakeholder and sentiment-analysis level rather than from the tourist's perspective (Alzahrani et al., 2025; Raza, 2025).

Against this background, the study addresses four research questions. (1) How does service quality influence optimum tourist satisfaction among international leisure tourists in Saudi Arabia? (2) How does destination cultural adaptability influence it? (3) Do digital readiness and AI applications contribute to satisfaction? (4) Does technology integration moderate the effects of service quality and cultural adaptability on satisfaction? The outcome is framed as optimum tourist satisfaction, a multidimensional construct that covers tangible outcomes (attractions, landscape, value for money), intangible outcomes (destination image, safety, social interaction) and overall satisfaction with its behavioural consequences (exceeded expectations, recommendation and revisit intention) (González et al., 2007; Zeng & Li, 2021; Bagheri et al., 2023).

The study makes three contributions. First, it integrates SERVQUAL, cultural-adaptability and smart-tourism perspectives in a single higher-order model tested on inbound leisure tourists, a segment rarely studied in Saudi Arabia. Second, it operationalises cultural adaptability at the destination level, using green practices, intercultural communication and inclusiveness. Most previous cultural-adaptation research has been qualitative or focused on the tourist (Lin et al., 2021; Fan et al., 2021). Third, it tests technology integration both as a direct predictor and as a moderator, and identifies the conditions under which the expected moderation does not appear. The remainder of the paper reviews the literature and develops the hypotheses (Section 2), describes the method (Section 3), reports the results (Section 4), discusses them (Section 5) and concludes with implications and limitations (Section 6).

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Theoretical Foundations

The study draws on three complementary perspectives. Expectancy–disconfirmation theory (Oliver, 1980) holds that satisfaction results from comparing perceived performance with prior expectations. Optimum satisfaction is reached when performance positively disconfirms those expectations (Renganathan et al., 2025). SERVQUAL (Parasuraman et al., 1988, 1991) specifies the performance attributes that tourists evaluate in service encounters. Because SERVQUAL is not culture-free and usually needs adaptation to its setting (Akbaba, 2006; Adhikari et al., 2023), the study adds a cultural-adaptability perspective. This perspective recognises that tourists from different cultural backgrounds interpret the same service cues differently (Basfirinci & Mitra, 2015; Ayyildiz, 2024), and that satisfaction in cross-cultural encounters depends on how well host behaviour fits the guest's norms (Agustina, 2025; Garrod & Nicholls, 2022). Finally, smart tourism research views digital infrastructure, AI and contactless systems as stimuli that shape tourists' cognitive and affective evaluations, consistent with the stimulus–organism–response framework (Chiengkul et al., 2025). In short, SERVQUAL captures what is delivered, cultural adaptability captures how appropriately it is delivered, and technology integration captures the digital context in which delivery takes place.

2.2. Optimum Tourist Satisfaction

Tourist satisfaction is usually defined as a post-consumption judgement that the experience met or exceeded expectations. This study focuses on optimum satisfaction: a state in which expectations are exceeded, positive affect is strong, and the visitor intends to recommend and return. The distinction matters because the conditions that avoid dissatisfaction are not necessarily those that create delight (Renganathan et al., 2025; Singh, 2021). Optimum satisfaction has tangible elements, such as satisfaction with heritage sites and attractions, landscape and atmosphere, and value for money. It also has intangible elements, such as a positive destination image, feelings of safety and security, and rewarding social interaction (González et al., 2007; Zeng & Li, 2021). Well-being and memorable experiences connect these evaluations to behavioural loyalty (Bagheri et al., 2023; Eviana, 2024). For Saudi Arabia, the intangible elements are especially important. International visitors' perceptions of safety, health risk and social acceptance are still forming (Memish et al., 2023). Saudi Arabia also competes with nearby, culturally familiar destinations that attract even its own residents (Alshammari et al., 2023), so its offer is judged

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against regional competitors. Optimum satisfaction is therefore modelled here as a higher-order construct covering tangible, intangible and overall outcomes.

2.3. Service Quality and Optimum Tourist Satisfaction

Service quality is repeatedly identified as a core antecedent of tourist satisfaction. Studies in tourism villages (Anggani et al., 2025; Kamal, 2025), heritage destinations (Nian et al., 2024; Eviana, 2024; Sasongko et al., 2025), community tourism (Liu et al., 2025) and single attractions (Pamungkas et al., 2025) report significant positive associations. Service quality also affects satisfaction indirectly, by creating memorable experiences (Eviana, 2024) and positive emotions (He et al., 2020). The evidence is, however, dimension-specific. In ski tourism, only responsiveness and assurance predicted leisure satisfaction, while tangibles, reliability and empathy did not (Kong et al., 2025). In hotels, reliability and assurance emerged as key drivers after the pandemic (Al-Kumaim et al., 2023). A PLS-SEM study of Kuala Lumpur hotel guests found no significant direct effect at all (Renganathan et al., 2025). These mixed results suggest that some dimensions act as hygiene factors, which prevent dissatisfaction without creating delight, while others generate positive disconfirmation, depending on the maturity of the destination (Singh, 2021). In an emerging destination such as Saudi Arabia, where visitors may arrive with uncertainty about service consistency, dependable and competent service is likely to exceed expectations. Hence:
H1. Service quality has a significant positive effect on optimum tourist satisfaction.

2.4. Cultural Adaptability and Optimum Tourist Satisfaction

Cultural adaptability refers to a destination's capacity to accommodate culturally diverse visitors, reduce intercultural friction and create a respectful and inclusive environment (Viken et al., 2021; Matteucci et al., 2022). Following the literature, the study conceptualises it through three components. Intercultural communication improves interaction quality and reduces misunderstanding. Roodhi et al. (2025) showed, with 581 tourists, that intercultural communication competence raised satisfaction through communication skills and interaction quality, and qualitative work links cultural competence to memorable cultural experiences (Lin et al., 2021; Fan et al., 2021). Inclusiveness and openness provide psychological safety and a sense of welcome, which are preconditions for delight (Atamanchuk, 2021; Flego & Tei, 2025). Green practices signal responsible stewardship and protect the environmental and heritage quality on which experiences depend (Cheng & Chen, 2022; Talukder, 2025; Jumadi, 2025). The relevance of these factors is heightened in Muslim-majority destinations. Garrod and Nicholls (2022) found that British tourists who adapted successfully to local cultural expectations reported greater satisfaction, whereas maladaptation reduced both satisfaction and well-being. Because a destination's adaptability eases this adjustment, the following is proposed:
H2. Cultural adaptability has a significant positive effect on optimum tourist satisfaction.

2.5. Technology Integration and Optimum Tourist Satisfaction

Technology integration refers to the use of digital infrastructure, AI and contactless technologies throughout the visitor journey (Zhang et al., 2025). Digital readiness (efficient digital systems, accessible online information and useful platforms) reduces uncertainty and increases tourists' sense of control. In Metro Cebu, digital infrastructure was the strongest predictor of visitor satisfaction ($\beta = .531$), ahead of sustainability practices and service innovation (Say, 2025). In Macau, accessibility of smart tourism technology was the strongest driver of satisfaction and happiness (Pai et al., 2020; see also Zhang et al., 2022). AI applications, including chatbots, recommendation engines and multilingual assistants, personalise services and help overcome language barriers (Ma, 2024; Samala et al., 2020). AI engagement has been shown to enrich smart experiences and happiness (Chiengkul et al., 2025) and to improve customer satisfaction in hospitality firms (Ali et al., 2025). Contactless technologies improve convenience, perceived safety and delight (Hao & Chon, 2021; Soliman et al., 2025). In the Saudi context, digital transformation is a central pillar of the national tourism strategy (Raza, 2025; Alzahrani et al., 2025). Accordingly:
H3. Digital readiness has a significant positive effect on optimum tourist satisfaction.
H4. Artificial intelligence applications have a significant positive effect on optimum tourist satisfaction.

2.6. The Moderating Role of Technology Integration

Technology may also change the strength of other relationships. Smart tourism technologies strengthened the effect of novelty seeking on travel satisfaction and weakened the effect of tourists' worries (Goo et al., 2022). Smart technology use amplified memorable experiences and revisit intentions (Torabi et al., 2022), and technology readiness moderated satisfaction with travel technologies across countries (Wang et al., 2016; Shin et

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al., 2021). Applied to this study, reliable digital systems may make good service more visible and consistent: real-time information increases transparency, AI tools support multilingual communication, and contactless systems reduce friction in culturally sensitive encounters. Technology integration is therefore expected to strengthen the positive effects of service quality and cultural adaptability:

H5a. Technology integration moderates the relationship between service quality and optimum tourist satisfaction, such that the relationship is stronger when technology integration is high.

H5b. Technology integration moderates the relationship between cultural adaptability and optimum tourist satisfaction, such that the relationship is stronger when technology integration is high.

Figure 1

Conceptual model

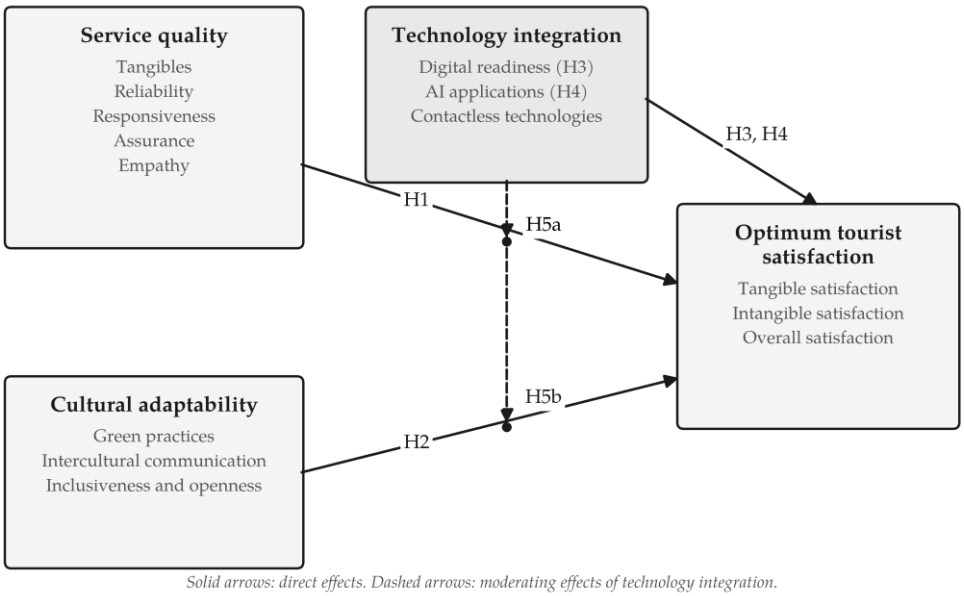


Figure 1 presents the conceptual model

Note. Service quality, cultural adaptability, technology integration and optimum tourist satisfaction are specified as reflective–reflective higher-order constructs.

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3. MATERIALS AND METHODS

3.1. Research Design, Population and Sampling

A cross-sectional, quantitative survey design was adopted. The target population was inbound international leisure tourists aged 18 or over who were not residents of Saudi Arabia and had visited the Kingdom for leisure, recreation or cultural and heritage purposes during the previous 12 months, using tourism services during that visit. Visitors travelling only for Hajj or Umrah, business, employment or education were excluded, because their motivations and service encounters differ substantially from those of leisure tourists (Kayal, 2023). A self-administered online questionnaire (Google Forms) was distributed through travel-related social media groups and online travel communities between August and September 2026, using convenience sampling with screening questions. An a priori power analysis (G*Power; $f^2 = .15$, $\alpha = .05$, $1 - \beta = .80$, 13 predictors) indicated a minimum of 131 responses, and the study aimed for at least 250.

Of the 523 responses received, 178 failed the eligibility screening, leaving 345 eligible respondents. There were no missing values because all items were mandatory. Five straight-lining cases (identical answers to all 43 items) and 27 multivariate outliers (Mahalanobis D^2, $p < .001$) were removed, leaving a final sample of 313. A sensitivity analysis with the outliers retained is reported in Section 4.5.

3.2. Measures

All constructs were measured with multi-item scales adapted from the literature and rated on five-point Likert scales (1 = strongly disagree; 5 = strongly agree). Table 1 summarises the instrument. The questionnaire was reviewed for content validity and pre-tested with 30 eligible tourists. All pilot reliabilities were acceptable

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(Cronbach's α = .938–.966 for the constructs). One contactless-technology item (E9) was reworded to reduce its overlap with E8.

Table 1 Measurement instrument

Construct (role)	Dimensions (items)	Sources
Service quality (IV)	Tangibles (C1–C3); reliability (C4–C6); responsiveness (C7–C9); assurance (C10–C12); empathy (C13–C15)	Parasuraman et al. (1988, 1991); Akbaba (2006); Adhikari et al. (2023)
Cultural adaptability (IV)	Green practices (D1–D3); intercultural communication (D4–D6); inclusiveness and openness (D7–D9)	Viken et al. (2021); Fan et al. (2021); Baloch et al. (2022); Flego and Tei (2025)
Technology integration (IV/moderator)	Digital readiness (E1–E3); AI applications (E4–E6); contactless technologies (E7–E9)	Pai et al. (2020); Hao and Chon (2021); Madurga and Méndez (2023); Abate et al. (2024)
Optimum tourist satisfaction (DV)	Tangible satisfaction (F1–F3); intangible satisfaction (F4–F6); overall satisfaction and behavioural intentions (F7–F10)	González et al. (2007); Zeng and Li (2021); Bagheri et al. (2023)

Note. IV = independent variable; DV = dependent variable. Full item wording is available in Appendix A.

3.3. Data Analysis

Partial least squares structural equation modelling (PLS-SEM) was used because the data were not multivariate normal (see Section 4.2), because the model contains higher-order constructs and interaction terms, and because the aim was to explain and predict satisfaction (Hair et al., 2019). All four constructs were specified as reflective–reflective higher-order constructs and estimated with the disjoint two-stage approach (Sarstedt et al., 2019). In stage 1, the 14 lower-order dimensions were estimated with their items. In stage 2, their latent variable scores served as indicators of the higher-order constructs. The model was estimated with mode A and the path weighting scheme. Significance was assessed with 5,000 bootstrap subsamples (percentile confidence intervals, two-tailed). Moderation was tested with the two-stage interaction approach, using products of standardised latent variable scores, and was followed by simple-slope analysis at ±1 SD of the moderator. Predictive relevance was assessed with $Q^2_{predict}$ using 10-fold cross-validation (Shmueli et al., 2019), and overall model fit with the standardised root mean square residual (SRMR) for the saturated and estimated models (Hu & Bentler, 1999).

The hypotheses were tested hierarchically. Model 1 estimated service quality and cultural adaptability (H1, H2). Model 2 added digital readiness, AI applications and contactless technologies (H3, H4). Model 3 added technology integration and the two interaction terms (H5a, H5b). As robustness checks, the models were re-estimated with hierarchical OLS regression on mean-centred composite scores, PROCESS Model 1 with 5,000 bootstrap samples, and the full eligible sample (N = 345).

Two software packages were used. SPSS was used for data preparation and descriptive analysis: coding, screening for missing values, straight-lining and outliers, frequencies, means, standard deviations, skewness, kurtosis, univariate normality tests and Harman's single-factor test (Pallant, 2010; Field, 2018). SmartPLS was used for the inferential analysis: the measurement model, model fit, the structural model, hypothesis testing and moderation. SmartPLS was preferred for this stage because PLS-SEM does not assume multivariate normality, estimates higher-order constructs and interaction terms directly, assesses the measurement and structural models in one analysis, and provides bootstrapped confidence intervals, HTMT, $Q^2_{predict}$ and SRMR (Hair et al., 2019; Henseler et al., 2015). The regression and PROCESS robustness checks were run in SPSS.

3.4. Ethical Considerations

Participation was voluntary and anonymous. Respondents were informed of the study purpose, their right to withdraw and the confidentiality of their responses before giving consent to proceed. No personally identifying information was collected. [Authors: insert institutional ethics approval details.]

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4. RESULTS

4.1. Respondent Profile

Table 2 Respondent profile (N = 313)

Characteristic	Category	n (%)
Gender	Female / male / prefer not to say	137 (43.8) / 101 (32.3) / 75 (24.0)
Age	18–25 / 26–35 / 36–45 / 46–55 / 56+	6 (1.9) / 72 (23.0) / 156 (49.8) / 63 (20.1) / 16 (5.1)
Purpose	Cultural/heritage / leisure and recreation	187 (59.7) / 126 (40.3)
Destination	Jeddah / Red Sea / AlUla / Riyadh	105 (33.5) / 104 (33.2) / 63 (20.1) / 41 (13.1)
Length of stay	< 3 days / 3–7 / 8–14 / > 14 days	23 (7.3) / 150 (47.9) / 115 (36.7) / 25 (8.0)
Nationality	France / Germany / UK / Poland / USA / other	93 (29.7) / 79 (25.2) / 57 (18.2) / 36 (11.5) / 31 (9.9) / 17

Table 2 shows the respondent profile. The sample was mainly aged 36–45 (49.8%) and slightly more female than male. Most respondents had made cultural or heritage-oriented trips (59.7%) and stayed 3–14 days (84.6%). Jeddah and the Red Sea region were the most visited destinations, and most respondents came from Western Europe and North America.

4.2. Descriptive Statistics, Normality and Common Method Bias

All construct means were above the scale midpoint: service quality M = 3.70 (SD = 1.11), cultural adaptability M = 3.70 (SD = 1.13), technology integration M = 3.73 (SD = 1.14) and optimum tourist satisfaction M = 3.72 (SD = 1.13). Digital readiness had the highest dimension mean (M = 3.79) and empathy the lowest (M = 3.66). Item skewness (−1.05 to −0.69) and kurtosis (−0.78 to −0.10) were within the conventional ±2 and ±7 limits. However, Shapiro–Wilk tests and Mardia's multivariate skewness and kurtosis were significant ($p < .001$), which supports the use of PLS-SEM. The response distribution was bimodal: about 21% of respondents (n = 66) rated all aspects of their visit low (item mean < 2.5), while the rest clustered between "agree" and "strongly agree".

Common method variance was assessed with procedural remedies (anonymity, separate sections, neutral wording) and two statistical tests (Podsakoff et al., 2003). A single unrotated factor explained 70.1% of item variance, and Kock (2015) full-collinearity VIFs (12.42–15.10) exceeded the 3.3 threshold. Common method variance, or a strong general evaluative tendency among respondents, therefore cannot be excluded, and it is considered when interpreting the results.

4.3. Measurement Model

Table 3 Measurement model: reliability and convergent validity

Construct / dimension	Item loadings	α	ρ_A	CR	AVE	Loading on HOC
Service quality		.967	.967	.974	.883	
Tangibles	.890–.926	.891	.893	.932	.821	.938
Reliability	.891–.908	.885	.885	.929	.813	.940
Responsiveness	.894–.924	.889	.889	.931	.819	.945
Assurance	.891–.924	.892	.893	.933	.822	.940
Empathy	.908–.927	.906	.906	.941	.841	.936
Cultural adaptability		.951	.952	.968	.911	
Green practices	.891–.929	.900	.903	.937	.833	.955
Intercultural communication	.892–.929	.893	.893	.933	.823	.948

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Construct / dimension	Item loadings	α	ρ_A	CR	AVE	Loading on HOC
Inclusiveness and openness	.906–.915	.895	.896	.935	.827	.959
Technology integration		.958	.958	.973	.922	
Digital readiness	.899–.930	.908	.910	.943	.845	.965
AI applications	.885–.908	.880	.880	.926	.807	.956
Contactless technologies	.901–.920	.896	.896	.935	.827	.960
Optimum tourist satisfaction		.964	.964	.977	.933	
Tangible satisfaction	.912–.925	.908	.908	.942	.845	.965
Intangible satisfaction	.900–.918	.891	.892	.932	.821	.962
Overall satisfaction	.876–.909	.910	.911	.937	.788	.972

Note. HOC = higher-order construct; CR = composite reliability; AVE = average variance extracted. Bold rows report the higher-order constructs estimated in stage 2. All loadings are significant at $p < .001$.
Table 3 reports the measurement model. All 43 item loadings (.876–.930) exceeded .708. Cronbach's α, ρ_A and composite reliability exceeded .70, and all AVE values exceeded .50 at both levels (Hair et al., 2019). Every dimension loaded strongly on its higher-order construct (.936–.972), which supports the higher-order specification.

Table 4 Discriminant validity of the higher-order constructs

Construct pair	Correlation	HTMT	95% CI
Service quality ↔ Cultural adaptability	.954	.995	[.982, 1.006]
Service quality ↔ Technology integration	.903	.939	[.884, .983]
Service quality ↔ Optimum tourist satisfaction	.887	.919	[.857, .967]
Cultural adaptability ↔ Technology integration	.905	.948	[.896, .992]
Cultural adaptability ↔ Optimum tourist satisfaction	.887	.926	[.865, .977]
Technology integration ↔ Optimum tourist satisfaction	.958	.997	[.979, 1.010]

Note. HTMT = heterotrait–monotrait ratio; confidence intervals from 5,000 bootstrap subsamples. The square roots of AVE are .940 (SQ), .954 (CA), .960 (TI) and .966 (OTS).
Discriminant validity was assessed with the Fornell–Larcker criterion (Fornell & Larcker, 1981) and the HTMT ratio (Henseler et al., 2015) (Table 4). All HTMT values exceeded .90. For service quality–cultural adaptability (HTMT = .995) and technology integration–satisfaction (HTMT = .997), the confidence intervals included 1, and the latent correlations exceeded the square roots of AVE. Discriminant validity was therefore not established for these two pairs. Respondents did not clearly distinguish service quality from the cultural appropriateness of service, or the quality of the digital journey from overall satisfaction. The structural results are reported with this limitation in mind. Because collinear predictors compete for shared variance, estimates of their unique effects are unstable.

4.4. Model Fit

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Table 5 Model fit: standardised root mean square residual (SRMR)

Model	Indicators	SRMR (saturated)	SRMR (estimated)	Result
Stage 1: lower-order model (14 constructs)	43	.031	.032	Good fit
Stage 2, Model 1: SQ, CA → OTS	11	.021	.021	Good fit
Stage 2, Model 2: SQ, CA, DR, AI, CT → OTS	20	.027	.027	Good fit
Stage 2, Model 3a: SQ, CA, TI → OTS	14	.020	.020	Good fit
Dimension model: eight SQ and CA dimensions → OTS	27	.033	.033	Good fit

Note. SRMR values below .08 indicate good fit (Hu & Bentler, 1999). SQ = service quality; CA = cultural adaptability; TI = technology integration; DR = digital readiness; AI = artificial intelligence applications; CT = contactless technologies; OTS = optimum tourist satisfaction.

Model fit was assessed with the SRMR, the square root of the average squared difference between the observed indicator correlations and those implied by the model (Table 5). The SRMR of the first-stage model was .031 (saturated) and .032 (estimated). For the second-stage models it ranged from .020 (Model 3a) to .027 (Model 2), and it was .033 for the dimension-level model. All values are well below the .08 cut-off, so the models reproduce the observed correlations closely. SRMR is not reported for the moderated model because fit indices are not meaningful for models with interaction terms. A good SRMR does not, however, offset the discriminant validity problem reported above.

4.5. Structural Model and Hypothesis Testing

Table 6 Structural model results and hypothesis testing

Path	β	t	p	95% CI	f^2	Decision
Model 1 (R^2 = .806; $Q^2_{predict}$ = .800)						
H1: SQ → OTS	.451	3.79	< .001	[.202, .663]	.094	Supported
H2: CA → OTS	.457	3.86	< .001	[.234, .698]	.097	Supported
Model 2 (R^2 = .921; $Q^2_{predict}$ = .913)						
SQ → OTS	.073	1.00	.317	[−.063, .225]	.005	
CA → OTS	.056	0.77	.441	[−.072, .208]	.003	
H3: DR → OTS	.327	4.88	< .001	[.190, .448]	.177	Supported
H4: AI → OTS	.251	5.86	< .001	[.154, .324]	.129	Supported
CT → OTS (control)	.298	5.78	< .001	[.193, .395]	.182	
Model 3 (R^2 = .922; ΔR^2 = .0007)						
SQ → OTS	.036	0.53	.596	[−.084, .186]	.001	
CA → OTS	.073	1.01	.313	[−.052, .229]	.004	
TI → OTS	.817	8.97	< .001	[.580, .930]	1.164	
H5a: SQ × TI → OTS	−.081	1.04	.296	[−.242, .067]	.005	Not supported
H5b: CA × TI → OTS	.031	0.48	.631	[−.090, .168]	.001	Not supported

Note. SQ = service quality; CA = cultural adaptability; TI = technology integration; DR = digital readiness; AI = artificial intelligence applications; CT = contactless technologies; OTS = optimum tourist satisfaction. 5,000

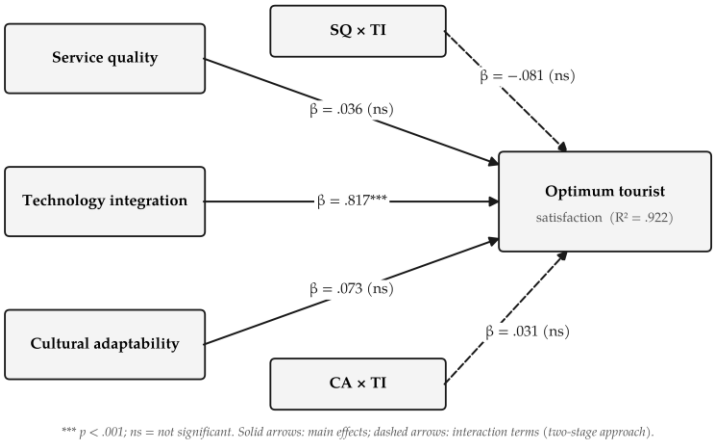
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bootstrap subsamples; percentile confidence intervals; t statistics are absolute values. In Model 3, ΔR^2 is relative to the main-effects model with SQ, CA and TI (R^2 = .921).

Table 6 presents the hypothesis tests. In Model 1, service quality (β = .451, t = 3.79, p < .001) and cultural adaptability (β = .457, t = 3.86, p < .001) had significant positive effects on optimum tourist satisfaction, supporting H1 and H2. Together they explained 80.6% of its variance, with high predictive relevance ($Q^2_{predict}$ = .800). The inner VIF (11.15) reflects the near-identity of the two predictors, so their coefficients should be read as a shared contribution split roughly equally.

In Model 2, digital readiness (β = .327, p < .001, f^2 = .177) and AI applications (β = .251, p < .001, f^2 = .129) significantly increased satisfaction, supporting H3 and H4. Contactless technologies was also significant (β = .298). Explained variance rose to 92.1%, and the unique effects of service quality and cultural adaptability became non-significant. In Model 3, technology integration had a very large effect (β = .817, p < .001). Neither interaction was significant: SQ × TI β = −.081, p = .296, 95% CI [−.242, .067]; CA × TI β = .031, p = .631, 95% CI [−.090, .168]. The interaction terms added only .0007 to R^2. H5a and H5b were therefore not supported.

Figure 2 Structural model with interaction terms (Model 3)



Note. Standardised path coefficients; *** p < .001; ns = not significant.

Figure 2 summarises the moderated model. The simple slopes confirmed the absence of moderation. The conditional effect of service quality was .117 at low, .036 at average and −.045 at high technology integration, and the corresponding effects of cultural adaptability were .042, .073 and .104. None of these effects was significant, and all confidence intervals overlapped.

4.6. Dimension-Level Effects and Robustness Checks

Table 7 Unique effects of service-quality and cultural-adaptability dimensions on optimum tourist satisfaction

Dimension	β	t	p	95% CI	f^2	VIF
Tangibles	.064	0.64	.523	[−.119, .268]	.004	6.02
Reliability	.286	3.17	.002	[.121, .460]	.076	5.85
Responsiveness	.016	0.24	.810	[−.122, .138]	.000	6.84
Assurance	−.013	0.19	.849	[−.150, .115]	.000	6.48
Empathy	.068	1.18	.240	[−.045, .182]	.004	6.17
Green practices	.080	1.11	.265	[−.038, .247]	.005	6.32
Intercultural communication	.193	3.04	.002	[.069, .319]	.033	6.03
Inclusiveness and openness	.267	4.24	< .001	[.142, .389]	.049	7.90

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Note. $R^2 = .815$. All eight dimensions were entered simultaneously as first-order constructs, with optimum tourist satisfaction as the higher-order outcome.

To identify which service and cultural factors matter most, the eight dimensions were entered simultaneously (Table 7). Only reliability ($\beta = .286$, $p = .002$), inclusiveness and openness ($\beta = .267$, $p < .001$) and intercultural communication ($\beta = .193$, $p = .002$) had significant unique effects. Tangibles, responsiveness, assurance, empathy and green practices did not. Because these dimensions are highly inter-correlated (VIF 5.85–7.90), non-significance indicates a lack of unique contribution rather than a lack of association.

The robustness checks confirmed the main conclusions. In hierarchical OLS regression, service quality and cultural adaptability were significant in the first step ($R^2 = .805$). Adding technology integration increased R^2 by .116 ($p < .001$), and the interaction terms added no significant variance ($\Delta R^2 = .0008$, $p = .223$). The PROCESS Model 1 bootstrap confidence intervals for both interactions included zero (SQ × TI: [−.120, .030]; CA × TI: [−.096, .035]). With the 32 excluded cases retained ($N = 345$), H1–H4 remained supported and H5a–H5b remained unsupported. The one difference was that cultural adaptability kept a small unique effect after technology integration was controlled ($\beta = .237$, $p < .001$).

5. DISCUSSION

5.1. Service Quality and Satisfaction

The significant effect of service quality (H1) agrees with the large body of evidence linking SERVQUAL-type evaluations to tourist satisfaction (Anggani et al., 2025; Kamal, 2025; Eviana, 2024; Nian et al., 2024; Liu et al., 2025), and extends it to international leisure tourism in Saudi Arabia. Two findings, however, refine this conclusion. First, service quality had no unique effect once technology integration was controlled. This echoes Renganathan et al. (2025), who found no direct service quality effect among Kuala Lumpur hotel guests, and supports the view that service quality is a necessary but insufficient condition for optimum satisfaction (Singh, 2021). Second, reliability was the only SERVQUAL dimension with a unique effect. This contradicts Kong et al. (2025), who found that responsiveness and assurance, not reliability, drove satisfaction in ski tourism. It agrees with Al-Kumaim et al. (2023) and with the expectancy–disconfirmation logic set out in Section 2.2. In mature destinations, reliable service is taken for granted and behaves as a hygiene factor. In an emerging destination, where visitors arrive unsure whether services will work as promised, reliability can positively disconfirm expectations and so contribute to delight. The non-significance of tangibles is consistent with this interpretation. Given Saudi Arabia's heavy investment in new infrastructure (Ibrahim, 2025), modern facilities may now be treated as a baseline, as Kong et al. (2025) observed in a mature setting. This contrasts with single-site studies that found physical evidence to be a key driver (Anggani et al., 2025; Budarsa et al., 2025).

5.2. Cultural Adaptability and Satisfaction

The support for H2 provides quantitative, destination-level evidence for an idea that has mostly been explored qualitatively or from the tourist's side (Lin et al., 2021; Fan et al., 2021; Adam, 2024). It is consistent with Roodhi et al. (2025), who linked intercultural communication to satisfaction, and especially with Garrod and Nicholls (2022), who showed that successful cultural adjustment raises the satisfaction of Western tourists in Muslim-majority destinations. Inclusiveness and openness was the strongest cultural dimension. This gives empirical weight to arguments that were largely conceptual or review-based (Atamanchuk, 2021; Flego & Tei, 2025), and it suggests that when visitors experience the openness that Saudi tourism reforms aim to project (Qurtuby, 2024), their satisfaction rises. In contrast, green practices had no unique effect. This does not match the expectations drawn from Cheng and Chen (2022), Talukder (2025) and Jumadi (2025), although none of those studies measured tourist satisfaction directly. A plausible explanation is that sustainability efforts are not yet visible enough in the short-stay visitor experience to shape satisfaction. They may matter more for long-term destination quality than for immediate evaluations.

A further, unexpected finding concerns the relationship between the two predictors. Service quality and cultural adaptability were almost indistinguishable ($r = .954$; HTMT = .995). This result supports the argument that culture is embedded in how service quality is perceived (Basfirinci & Mitra, 2015; Ayyildiz, 2024; Agustina, 2025). For international visitors, what is delivered and how culturally appropriately it is delivered appear to form a single evaluation of the service encounter. The literature has treated these as complementary but separate lenses. The present evidence suggests that "culturally adapted service quality" may be the more realistic unit of analysis in cross-cultural destinations.

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5.3. Technology Integration: A Parallel Pathway Rather Than an Amplifier

The support for H3 and H4 closely replicates Say (2025), who found digital infrastructure to be the strongest predictor of visitor satisfaction. It also agrees with evidence that smart-technology accessibility (Pai et al., 2020; Zhang et al., 2022), AI engagement (Chiengkul et al., 2025; Ali et al., 2025) and contactless services (Hao & Chon, 2021; Soliman et al., 2025) improve tourist outcomes. The study is among the first to provide tourist-level evidence of these effects in Saudi Arabia, where earlier work examined technology through policy, stakeholder or sentiment-analysis lenses (Raza, 2025; Alzahrani et al., 2025). Digital readiness was the highest-rated dimension, which suggests that the Kingdom's digital investment is visible to visitors and valued by them.

The rejection of H5a and H5b contradicts studies that report moderating effects of smart technology or technology readiness (Wang et al., 2016; Shin et al., 2021; Goo et al., 2022; Torabi et al., 2022). Three differences may explain the discrepancy. First, those studies moderated other relationships, such as novelty, worry and memorable experience, rather than SERVQUAL and cultural adaptability. Second, most measured the traveller's personal technology readiness, whereas this study measured perceived destination technology. Third, Hao and Chon (2021) showed that contactless services benefit low-readiness travellers most. Moderating effects that run in opposite directions for different segments can cancel out in pooled samples, a possibility reinforced by the subgroup differences reported by Roodhi et al. (2025). Taken together, the results suggest that in Saudi Arabia technology integration acts as a parallel, direct pathway to satisfaction rather than as an amplifier of service and cultural factors. The negative but non-significant SQ × TI coefficient is at least consistent with a compensatory role, in which technology partly substitutes for weaker interpersonal service. Future research should test this possibility. Nevertheless, the very high correlation between technology integration and satisfaction (HTMT = .997) indicates that visitors' evaluations of the digital journey and of the trip as a whole were formed together. The size of the technology effect should therefore not be read as evidence that technology can replace human service (Samala et al., 2020).

5.4. Interpreting the Findings in the Saudi Context

Three features of the Saudi context help explain the pattern of results. First, the destination is in transition. The move from a pilgrimage-centred model to diversified leisure tourism has been fast (Ali & Salameh, 2021; Qurtuby, 2024), and infrastructure has expanded more quickly than governance and service systems (Ibrahim, 2025). In this setting, the basic promise of service delivery is not yet taken for granted, which explains why reliability, rather than extra-role responsiveness or personalised empathy, differentiated satisfied from dissatisfied visitors. Second, most respondents came from culturally distant Western societies and were visiting a conservative Muslim-majority country for the first time. For them, the social climate of the destination, whether they felt welcome, understood and accepted, is part of the core product rather than a peripheral attribute (Garrod & Nicholls, 2022). The prominence of inclusiveness and intercultural communication, and the fusion of cultural and service evaluations, are consistent with this. Third, digital transformation is a flagship element of Vision 2030 (Raza, 2025). E-visas, national tourism platforms, cashless payment and app-based access to AlUla and the Red Sea projects mean that much of the visitor journey is now mediated digitally. Where the digital layer is this pervasive, visitors may judge the digital journey and the trip as a whole together, which helps to explain why technology integration dominated the model and did not act as a separate amplifier.

The bimodal response pattern also has a contextual interpretation. About one-fifth of respondents evaluated every attribute of their visit negatively, rather than criticising specific services. Global, undifferentiated dissatisfaction of this kind is typical when expectations are violated at the level of the whole experience, for example through cultural discomfort, perceived restrictions or poor value for money, rather than through isolated service failures. This underlines the practical importance of identifying and recovering this segment, and it cautions against reading average effects as applying equally to all visitors (Roodhi et al., 2025; Wang et al., 2016).

5.5. Theoretical Implications

The study makes four theoretical contributions. First, it contextualises SERVQUAL for an emerging destination, showing that reliability rather than responsiveness or assurance is the SERVQUAL dimension most strongly linked with optimum satisfaction. This supports the contextual view of service quality (Akbaba, 2006; Adhikari et al., 2023) and suggests that the diagnostic value of a dimension depends on destination maturity. Second, it operationalises cultural adaptability at the destination level and validates it quantitatively, identifying inclusiveness and intercultural communication as its active components. Third, it integrates three research streams that have developed in isolation (Zhang et al., 2025). The integration shows that service and cultural evaluations merge into a single judgement of "culturally adapted service", and that technology forms a distinct and dominant pathway. Fourth, it adds a boundary condition to smart tourism theory: destination-level technology integration

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did not moderate service or cultural effects, so the moderating role reported in earlier studies may depend on whether technology is modelled as a traveller trait or as a destination attribute.

5.6. Practical Implications

The findings offer several implications for Saudi tourism authorities and service providers. First, reliability should be the operational priority: accurate bookings, punctual tours and transport, consistent standards across outlets and fast service recovery. Service-level standards and mystery-shopper audits are practical tools for achieving this. Second, inclusiveness and intercultural communication should be institutionalised through structured language and cultural-sensitivity training for front-line staff (Badu-Baiden et al., 2025; Miguel, 2024), clear and respectful guidance on local norms, and visible signals of welcome to visitors of all backgrounds. Third, investment in digital readiness, AI and contactless services should continue. This includes reliable connectivity at attractions, integrated multilingual platforms, AI trip assistants and universal contactless payment, with human support kept available for complex or sensitive situations (Samala et al., 2020; Ma, 2024). Fourth, because tourists do not separate service from culture, training and quality standards should combine operational excellence with cultural respect rather than treat them as separate programmes. Fifth, green practices should be made visible through interpretation, eco-labelling and visible resource-saving measures, so that sustainability becomes part of the experience. Finally, the fifth of visitors who rated everything poorly deserve attention. Routine post-visit surveys and AI-based sentiment monitoring (Alzahrani et al., 2025) could identify the destinations, providers and touchpoints behind these experiences. Recovering this segment is likely to raise overall satisfaction more than further improvements for visitors who are already satisfied.

6. CONCLUSIONS

This study examined the determinants of optimum tourist satisfaction among international leisure tourists in Saudi Arabia. Service quality and cultural adaptability each increased satisfaction, driven mainly by reliability, inclusiveness and openness, and intercultural communication. Digital readiness and AI applications also increased satisfaction, and technology integration emerged as the strongest single predictor. Contrary to expectations, technology did not strengthen the effects of service quality or cultural adaptability; it operated as a parallel pathway. For a destination competing for international visitors under Vision 2030, the message is that dependable service, a genuinely welcoming intercultural climate and a seamless digital journey must be developed together.

6.1. Limitations and Future Research

Several limitations qualify these conclusions. First, discriminant validity was not established between service quality and cultural adaptability, or between technology integration and satisfaction, and the tests indicated possible common method variance. Unique effects, particularly the non-significance of service and cultural factors once technology was controlled, should therefore be interpreted cautiously. Future studies should separate the measurement of predictors and outcomes in time, use marker variables or objective data (e.g., online reviews), and consider testing “culturally adapted service quality” as a single construct. Second, the cross-sectional design precludes causal inference. Third, convenience sampling through online communities produced a predominantly European and North American sample, which limits generalisability to visitors from Asia and the Gulf region. Fourth, the bimodal response pattern indicates unobserved heterogeneity. Latent-class or multi-group analyses by nationality and destination (Roodhi et al., 2025) are recommended. Fifth, traveller technology readiness (Wang et al., 2016; Shin et al., 2021) should be modelled alongside destination technology to test the boundary condition proposed here. Finally, mediators such as memorable tourism experience (Eviana, 2024) and emotions (He et al., 2020) would help explain how service, culture and technology translate into optimum satisfaction.

Declarations

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Data availability: The anonymised dataset supporting the findings of this study is available from the corresponding author upon reasonable request.
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