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Article

Low-carbon tourism resilience and destination loyalty: The roles of failure factors, communication quality, and tourist satisfaction

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Abstract: Sustainable tourism has emerged as an important approach in achieving a harmonious balance between economic development and environmental protection in destinations following low carbon development approaches. This study explores the working mechanism of resilient low carbon tourism destinations through exploring failure management, infrastructure resilience, low carbon practices, and communication quality at major destinations in Thailand, such as Bangkok, Phuket, and Chiang Mai. The study made use of an explanatory sequential mixed methods approach whereby quantitative data was first collected from 602 tourists and followed by an interpretative approach using semi-structured interviews conducted among 30 individuals. The results of structural equation modeling (SEM) analysis show that low carbon practices, infrastructure resilience, and communication quality positively affect tourist satisfaction, while perceived failure dimensions have an adverse impact on satisfaction and destination loyalty indirectly. In particular, the qualitative phase focused on providing explanations related to the findings of SEM analysis with special attention paid to tourist perception and experience of implemented strategies aimed at enhancing resilience and sustainability at tourist destinations. Thematic analysis of interview data allowed the emergence of several themes, including perceived failures of services and the environment, low carbon adaptation, infrastructure resilience, and open communication promoting trust and loyalty.

Keywords: low-carbon tourism; destination loyalty; tourist satisfaction; infrastructure resilience; environmental governance; sustainable tourism

1. Introduction

In the twenty-first century, tourism is one of the primary sources of economic growth and regional development and a significant contributor to GDP, employment infrastructure development, and internationalization in countries like Thailand [1,2]. Nonetheless, the high growth rate of tourism has exacerbated environmental stresses, such as augmented carbon discharge, resource consumption, and socio-ecological defenselessness [3,4]. Mass tourism, transport networks that are energy intensive, poor waste disposal, and uncontrolled development of destinations have posed a question on the sustainability of economies that rely on tourism in the long term [5]. In reaction, the discourse of global policy is becoming more focused on low-carbon transitions and resilient development pathways, which balance economic growth and environmental protection and are consistent with the United Nations Sustainable Development Goals (SDGs), especially SDG 8, SDG 11, SDG 12, and SDG 13[6].

Low-carbon tourism systems have become an effective strategy of sustainable destination management, that incorporates the use of renewable energy, eco-mobility, eco-certified hotels, smart tourism, and carbon reduction [7,8]. A significant number

of initiatives have been actively promoted by Thailand on both the national and regional levels, making green development and ecological modernization a priority of policies [9,10]. Even with such developments, the final element defining the success of the low-carbon systems is the perceptions and experiences of the tourists, and the satisfaction and destination loyalty is an important measure of long-term competitiveness [11,12].

However, service interruption, overcrowding, environmental degradation, poor infrastructure, policy implementation loopholes, and crisis issues, including climate-related hazards and health crises, are common failure factors of tourism systems [13]. Such failures have the potential to undermine tourist confidence, harm destination image and decrease loyalty intentions [14]. Communication is very important in reducing such impacts by increasing transparency levels, creating trust, and promoting responsible tourist practices, especially in accordance with SDG 12 and SDG 13 [15,16]. On the other hand, ineffective communication may increase the level of dissatisfaction and undermine the relationships with tourists over the long term.

Although there is an increasing body of research on sustainable tourism and destination loyalty, there is still an evident gap in the knowledge of how failure aspects get intertwined with resilience processes, quality of communication, and low-carbon action in a single analytical context. The majority of the existing research considers sustainability initiatives as independent predictors of satisfaction without considering the vulnerabilities of the system and dynamics of disruption. Moreover, there is a paucity of empirical data on the functionality of these relations in different regional situations in Thailand, especially in determining the perceptions and behavioral effects on tourism.

In order to fill this gap, the current study examines the role of factors of failure, communication process, and resilience strategies in determining the level of tourist satisfaction and destination loyalty in the low-carbon tourism systems in Thailand. To be precise, the study will: (1) investigate how low-carbon practices, infrastructure resilience, and the quality of the communication affect the satisfaction of the tourists; (2) determine how the perceived failure factors affect the satisfaction and loyalty of the tourists; and (3) test the mediating power of satisfaction on the destination loyalty.

In line with this, the research questions that guide the study are as follows:

RQ1: What is the extent to which environmental management quality, low carbon initiatives, infrastructure resilience, and communication quality affect tourist satisfaction at resilient low-carbon tourism destinations?

RQ2: To what extent do the factors related to service failures, environmental failures, communication quality, and tourist satisfaction affect tourist destination loyalty?

RQ3: Is tourist satisfaction a mediator between low carbon initiatives and destination loyalty within resilient low-carbon tourism systems?

The research has a contribution to the existing literature as it combines the resilience theory, service failure viewpoints, and sustainable tourism in one framework. It provides empirical evidence based on various destinations in Thailand, which contributes to the better contextualization of low-carbon tourism systems. In a practical sense, the results offer practical implications on the policymakers and destination managers in an attempt to strike a balance between sustainability

aspirations and competitive positioning.

The rest of the paper is organized in the following way: the following section is the review of the relevant literature and formulating hypotheses, and then there is the section of the methodology which details the research design and data collection processes. The results and discussion are given in the following sections and the paper ends with implications, limitations and future research directions.

2. Materials and methods

This research uses a sequential explanatory mixed-method approach which combines covariance-based Structural Equation Modelling (SEM) and qualitative thematic analysis to achieve complete understanding of resilient low-carbon tourism systems. The quantitative phase employs SEM using SPSS and AMOS to test complex structural relationships, mediation effects, and multi-group differences across destinations, offering stronger examination of structural relationships and model validation compared to many prior studies that rely on single-method or cross-sectional regression techniques. The subsequent qualitative phase enriches these findings through in-depth thematic analysis, enabling contextual interpretation of resilience and communication processes. The integrated design of this study enables researchers to examine both statistical relationships and personal experiences which exist within fluctuating tourism environments.

2.1. Research design

The research design used in this study is a sequential explanatory mixed-method research design as it investigates the role of failure factors and the quality of communication in contributing to the satisfaction of tourists and their long-term destination loyalty in strong low-carbon tourism systems in Thailand. The study is carried out in three provisionally chosen regions in Thailand that have actively implemented low-carbon and sustainable tourism initiatives in their regional development strategies: Bangkok, Phuket, and Chiang Mai. In these regions, the specific study sites include sustainable urban tourism districts in Bangkok, eco-friendly coastal resort areas in Phuket, and community-based and cultural heritage tourism zones in Chiang Mai. These destinations are chosen because they have undertaken active measures of implementing green mobility systems, the adoption of renewable energy in their tourism infrastructure, eco-certification, and effective governmental sustainability communication strategies. The multi-site model facilitates external validity as well as makes comparative evaluation of resilience practices in the coastal, urban-smart, and eco-heritage tourism settings.

The sequential explanatory mixed-method design utilized by the research was conducted through two interrelated phases, ensuring the methodology integration between both the quantitative and qualitative portions of the investigation. Firstly, the Covariance-based Structural Equation Modelling (SEM) was utilized to analyze the structural relations among failure factors, the quality of environmental management, the quality of infrastructure, the use of low-carbon practices, communication quality, tourist satisfaction and destination loyalty. The findings of the statistical analysis informed the development of the interview guide for the second part of the study. In

particular, interview questions focused on explaining the SEM findings, especially the negative impact of perceived failure factors on tourist satisfaction, positive contribution of communication quality towards destination loyalty, and the mediating effect of tourist satisfaction on the relationship between low-carbon practices and destination loyalty.

Hence, the qualitative data collection was a complementary step aimed at explaining the findings obtained from SEM. The process of methodology integration took place at the interpretation stage, when the themes identified in the interviews were compared with the findings of SEM in order to interpret their operational meaning and significance.

2.2. Study population, sampling, and sample size

The target population includes all domestic and international tourists who traveled to the chosen locations during the time period from July until September 2025 which marked the highest tourist activity period in Thailand. The researchers employed a stratified random sampling method to obtain equal representation from three different provinces which helped them understand how their results applied to different types of urban and coastal and eco-cultural tourism areas. The approach receives justification because tourist profiles and destination feature exhibit diversity which allows researchers to reduce sampling errors while making sure all groups receive proper representation. The research team required a sample size of 630 respondents according to power analysis requirements for covariance-based Structural Equation Modelling (SEM) which developed the 10-times rule for complex models. The determination of sample size involved adhering to the recommendations for covariance-based Structural Equation Modelling (SEM) concerning both power considerations and model complexity considerations. First, power analysis was performed according to the recommendation for SEM studies that have medium-sized effects with significance levels of 0.05 and statistical powers above 0.80. Thus, it is indicated that a minimum sample greater than 500 would be sufficient for the estimation of the parameters and performing the mediation analysis. Second, in order to justify the sample size, the so-called "10-times rule" was used, suggesting that a minimum sample should exceed ten times the largest number of the structural paths directing towards any latent variable in the proposed model. Because in the current research there were several paths that were directed to the most complicated endogenous construct, the obtained valid sample size of 602 far exceeded the threshold set by the "10-times rule." After the research team screened data to eliminate missing information and outliers and inconsistent responses they obtained 602 valid responses which resulted in a response validity rate of 95.6% that exceeded the SEM threshold while enabling strong multi-group analysis. The research method has strong elements but it still contains a risk of selection bias which cannot be completely eliminated. The distribution of surveys through on-site methods and QR codes tends to favor tourists who possess higher technological skills and show greater willingness to participate which leads to an underrepresentation of less engaged tourists who have limited time. Peak tourist season data collection will create seasonal bias because tourists will show different behavior and satisfaction levels and their perceptions will differ compared to

off-peak periods. The research method implemented interval sampling, which selected every fifth tourist to limit researcher bias, but the study still faced self-selection bias because respondents chose to participate based on their strong positive or negative experiences. The researchers recognized the study limitations, but they used stratification and systematic sampling methods to decrease their effects.

2.3. Quantitative phase

2.3.1. Measurement items

The research utilizes seven fundamental elements that researchers extracted from resilience theory. The study uses seven variables, which researchers derived from two different resilience theories. The first variable of the study tracks (1) Failure Factors (FF) while the second variable tracks (2) Perceived Environmental Management Quality (EMQ) and the third variable tracks (3) Infrastructure Resilience (IR) and the fourth variable tracks (4) Low-Carbon Practices (LCP) and the fifth variable tracks (5) Communication Quality (CQ) and the sixth variable tracks (6) Tourist Satisfaction (TS) and the seventh variable tracks (7) Long-Term Destination Loyalty (DL). The research study uses established measurement scales from tourism and service quality and sustainability research to create seven distinct constructs through its operationalization. The research used service failure and destination risk literature to create measurement items which assess the perceived service failures and visitor congestion and environmental harm and government policy inconsistencies of the testing subjects. Environmental Management Quality (EMQ) assessment uses sustainable destination management scales to measure waste management success and environmental protection and environmental governance indicators [17,18]. The researchers evaluated Infrastructure Resilience (IR) through measurement items which assessed adaptive infrastructure and renewable energy systems and smart tourism technology based on research into resilience and tourism infrastructure [19,20]. The study uses observable sustainability actions which include green transport and eco-certified accommodations and carbon reduction initiatives to assess Low-Carbon Practices (LCP) based on research about low-carbon tourism and pro-environmental behavior [21,22]. The dimension of Communication Quality (CQ) combines four elements which are transparency and sustainability message clarity and crisis communication and digital engagement according to existing research about communication and service quality [23,24]. Tourist Satisfaction (TS) is measured as an overall evaluation of travel experience using widely validated satisfaction scales [25,26]. The framework of Destination Loyalty (DL) measures three components which include revisit intention and word-of-mouth and advocacy behavior according to established loyalty frameworks in tourism [27,28]. The study used a five-point Likert scale to measure all items which researchers adapted for the low-carbon tourism context in Thailand while maintaining content validity through prior empirical usage.

2.3.2. Data collection

The data collection instrument consists of a structured questionnaire developed on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The measurement items are developed based on the existing validated scales of tourism resilience and sustainability and adapted to the Thailand tourism context. The

questionnaire was originally developed in English and then translated into Thai through the back-translation method to ensure linguistic equivalence. The multi-stage validation process serves to improve control over instrument quality. Five academic experts in tourism management and sustainability assess content validity through their evaluation of item relevance, clarity, and contextual appropriateness. The Content Validity Index (CVI) scores for all constructs show values that exceed the minimum requirement of 0.80. The cognitive pre-testing process involves 15 tourists who evaluate item comprehension while researchers eliminate any unclear terms. The research team conducts a pilot study with 60 tourists to evaluate both instrument reliability and clarity. The internal consistency of all constructs shows confirmation through Cronbach's alpha values which exceed 0.78. The pilot Exploratory Factor Analysis (EFA) demonstrates that items properly load onto their assigned constructs without displaying significant cross-loadings. A pilot test is conducted with 60 tourists to examine reliability and clarity. Cronbach's alpha values for all constructs are above 0.78 during the pilot test, which confirms internal consistency.

The final survey is administered both online and offline. QR codes are placed at visitor centers, eco-transport stations, and entrance points of major attractions in studied tourist destinations. Research assistants approach tourists systematically through interval sampling (every fifth exiting tourist) to minimize selection bias. Participation in the survey is voluntary, and informed consent is sought before data collection. Respondents are screened to ensure they have engaged in at least one full day of tourism activities in the destination to provide experiential assessments.

2.3.3. Data analysis

Data analysis is done using SPSS 28 and AMOS 26. Preliminary data analysis involves descriptive statistics, tests for normality (skewness and kurtosis), and Harman's single-factor test for common method variance. Reliability analysis is done using Cronbach's alpha and Composite Reliability (CR), with thresholds above 0.70. Convergent validity is tested using Average Variance Extracted (AVE), with values above 0.50 acceptable. Discriminant validity is tested using the Fornell-Larcker criterion and the HTMT ratios.

Confirmatory Factor Analysis (CFA) is used to validate the measurement model. Model fit indices are tested using multiple fit indices: $\chi^2/df < 3.0$, CFI > 0.90, TLI > 0.90, RMSEA < 0.08, and SRMR < 0.08. After validating the measurement model, Structural Equation Modelling (SEM) is used to test hypothesized relationships between constructs. Mediation effects of Tourist Satisfaction on resilience-related variables and Destination Loyalty are tested using bootstrapping with 5,000 resamples. Multi-group SEM analysis is used to compare structural path differences among the three provinces to test differences in resilience effectiveness.

2.3.4. Structural regression equations

The proposed model equations represent a structured system of relationships tested using Structural Equation Modelling (SEM), where each equation corresponds to a specific stage in the causal framework. Model 1 explains how Low-Carbon Practices (LCP) are influenced by Environmental Management Quality (EMQ) and Infrastructure Resilience (IR), indicating that both governance quality and adaptive infrastructure jointly shape sustainability practices. Model 2 establishes the factors that

determine Tourist Satisfaction (TS) by showing how Failure Factors (FF) decrease satisfaction yet Low-Carbon Practices (LCP) and Communication Quality (CQ) increase it. The main driver of Destination Loyalty (DL) for Tourist Satisfaction (TS) proceeds through Communication Quality (CQ) which directly affects both variables. The mediation equations demonstrate that LCP and FF create indirect effects on Destination Loyalty through Tourist Satisfaction because satisfaction acts as the primary link between system characteristics and behavioral results.

Model 1: Determinants of low-carbon practices (LCP)

$$\text{“LCP”} = \beta\_1\ (\text{“EMQ”}) + \beta\_2\ (\text{“IR”}) + \varepsilon\_1 \quad (1)$$

Model 2: Determinants of tourist satisfaction (TS)

$$\text{“TS”} = \beta\_3\ (\text{“FF”}) + \beta\_4\ (\text{“LCP”}) + \beta\_5\ (\text{“CQ”}) + \varepsilon\_2 \quad (2)$$

Model 3: Determinants of destination loyalty (DL)

$$\text{“DL”} = \beta\_6\ (\text{“TS”}) + \beta\_7\ (\text{“CQ”}) + \varepsilon\_3 \quad (3)$$

Mediation model equations

$$\text{Indirect Effect 1: LCP} \rightarrow \text{TS} \rightarrow \text{DL} \quad (4)$$

$$\text{“Indirect Effect”} = (\text{LCP} \rightarrow \text{TS}) \times (\text{TS} \rightarrow \text{DL}) \quad (5)$$

$$\text{Indirect Effect 2: FF} \rightarrow \text{TS} \rightarrow \text{DL} \quad (6)$$

$$\text{“Indirect Effect”} = (\text{FF} \rightarrow \text{TS}) \times (\text{TS} \rightarrow \text{DL}) \quad (7)$$

The proposed model equations represent a structured system of predictive and associative relationships tested using Structural Equation Modelling (SEM) where each equation corresponds to a specific stage in the proposed structural framework. Although SEM allows for the analysis of intricate predictive and association relationships between variables, the cross-sectional characteristics of the data collected prevent the drawing of any concrete causal inferences. Hence, the results can only be considered as demonstrating structural relationships and predictive relationships, not as evidence of causation.

2.4. Qualitative phase

The qualitative phase used an interpretive research design to create contextual understanding which explained the quantitative results. The research team conducted their qualitative study in three major Thai tourist areas which included Bangkok and Phuket and Chiang Mai while the survey study took place in China. The study selected these destinations because they demonstrate three different types of tourism systems which include urban mass tourism in Bangkok and coastal low-carbon resort-based tourism in Phuket and eco-cultural heritage tourism in Chiang Mai. The research used qualitative methods to gather data through 30 semi-structured interviews which took place between October and December 2025. The sample included 18 tourists (6 per destination) and 6 tourism business managers (2 per destination) and 6 local tourism policymakers or sustainability officers (2 per destination). The study used purposive sampling to select participants who had direct knowledge of sustainability programs

and service interruptions and environmental conservation efforts which existed at the site. Tourists needed to stay for two nights as a minimum requirement because this period provided enough time for them to experience the local tourism system, while managers and policymakers had to meet the three-year professional requirement in either tourism or sustainability governance.

The interviews lasted between 45 and 70 minutes while participants chose to conduct their interviews in either English or Thai. The interview process followed a structured guide which examined service and environmental failures while participants expressed their views on visible low-carbon initiatives and their trust in destination communication strategies and how these elements affected their satisfaction and intention to return. The research team recorded the interviews after obtaining consent which they transcribed word-for-word while anonymizing all content to protect participant privacy rights. Thematic analysis followed Braun and Clarke's six-step procedure: (1) familiarization with the data through repeated reading of transcripts; (2) generation of initial codes reflecting recurring ideas and perceptions; (3) searching for potential themes by clustering related codes; (4) reviewing themes for coherence and consistency; (5) defining and refining themes to ensure conceptual clarity; and (6) producing the final analytical narrative linking themes to the broader research framework. The researchers utilized NVivo 14 software to create a structured system for coding and managing their qualitative research data. Two researchers independently coded the transcripts to enhance reliability results which showed an inter-coder agreement coefficient of 0.85 that demonstrated strong consistency in their coding process.

2.5. Ethical statement

The ethical approval for conducting this study is sought from the research ethics committee of the affiliated university in Thailand. The anonymity and confidentiality of the participants are ensured. No personal identifiable information is collected. The data is stored in a secure manner and used only for research purposes.

3. Results

3.1. Statistical findings

The presented empirical study of 602 valid responses received among the tourists in Bangkok, Phuket, and Chiang Mai in Thailand is strong statistical evidence in favor of the proposed resilient low-carbon tourism framework. The demographic profile shows that there is a rather equal gender distribution, where 52.8% of the respondents were males, and 47.2% were females. The highest age bracket was 26 – 35 years (32.9%), then 36-45 years (25.6%), and 18 – 25 years old (23.6%), indicating that most of the respondents were middle-aged and young adults- this is an economically active and environmentally conscious group. The majority of the respondents were well educated, with the highest number having a bachelor's degree (53.8%), meaning that the sample displayed enough academic competence to make informed judgments on how to enhance sustainable initiatives. The sample comprised 79.4% domestic tourists, as the two main tourist flows in the Thailand sustainable destination markets

are domestic tourists **Table 1**.

Table 1. Top 10 highest-cited documents.

Variable	Category	Frequency	Percentage (%)
Gender	Male	318	52.8
	Female	284	47.2
Age	18–25	142	23.6
	26–35	198	32.9
	36–45	154	25.6
	46–55	78	13.0
	56+	30	5.0
Education	High school	96	15.9
	Bachelor's	324	53.8
	Master's	148	24.6
	Doctorate	34	5.6
Province visited	Bangkok	201	33.4
	Phuket	200	33.2
	Chiang Mai	201	33.4
Tourist type	Domestic	478	79.4
	International	124	20.6

The descriptive statistics (**Table 2**) demonstrate that perceptions about resilience and sustainability initiatives are generally positive. Destination Loyalty (Mean = 3.88, SD = 0.64) and Tourist Satisfaction (Mean = 3.85, SD = 0.61) have the highest mean score, which indicates that tourists, in general, provided positive post-visit reviews on the destination and expressed intentions to visit it again. The mean of Low-Carbon Practices was also high (3.81), which means that green mobility systems, using renewable energy, and eco-certifications are known to people in the chosen destinations. The Quality of Communication (Mean = 3.76) and Infrastructure Resilience (Mean = 3.74) were also rated positively. Comparatively, Failure Factors had a relatively lower mean (3.02); it reflects moderate perceptions of service or environmental deficiencies, not by any means negative. The findings of reliability and convergent validity indicate a well-developed psychometric strength. The values of Cronbach's alpha were between 0.861 (Failure Factors) and 0.918 (Destination Loyalty), which are higher than the recommended value of 0.70. The Composite Reliability (CR) values were between 0.874 and 0.928; this showed internal consistency. The values of the AVE were ranging 0.636 to 0.763, which exceeded the value of 0.50, and thus proved convergent validity. Strong factor loading of the measurement model is also supported by strong standardized factor loading, with most of them standing at above 0.80 and above. To illustrate, Low-Carbon Practices items had loadings between 0.83 and 0.88, and Tourist Satisfaction items had loadings between 0.85 and 0.88, indicating that the indicators are good measures thereof.

Table 2. Construct reliability and validity.

Construct	Mean	SD	Cronbach's α	CR	AVE
Failure Factors (FF)	3.02	0.71	0.861	0.874	0.636
Environmental Management Quality (EMQ)	3.68	0.65	0.889	0.902	0.697
Infrastructure Resilience (IR)	3.74	0.63	0.872	0.888	0.665
Low-Carbon Practices (LCP)	3.81	0.66	0.903	0.915	0.728
Communication Quality (CQ)	3.76	0.67	0.895	0.907	0.710
Tourist Satisfaction (TS)	3.85	0.61	0.912	0.921	0.744
Destination Loyalty (DL)	3.88	0.64	0.918	0.928	0.763

The use of the Fornell-Larcker criterion (**Table 3**) in testing discriminant validity indicates that each construct has been empirically different. The square root of the AVE of each construct (e.g., 0.873 of Destination Loyalty and 0.863 of Tourist Satisfaction) was greater than inter-construct correlations. It is worth noting that even though there was a strong correlation between Tourist Satisfaction and Destination Loyalty (r = 0.81) (**Figure 1**), the square root of AVE values in both constructs was higher than the correlation, and this confirmed the discriminant validity, but at the same time indicated a high structural relationship.

Table 3. Discriminant validity matrix.

Construct	FF	EMQ	IR	LCP	CQ	TS	DL
FF	**0.798**						
EMQ	-0.42	**0.835**					
IR	-0.38	0.54	**0.816**				
LCP	-0.36	0.61	0.66	**0.853**			
CQ	-0.29	0.57	0.60	0.68	**0.843**		
TS	-0.48	0.63	0.59	0.72	0.70	**0.863**	
DL	-0.44	0.58	0.55	0.69	0.71	0.81	**0.873**

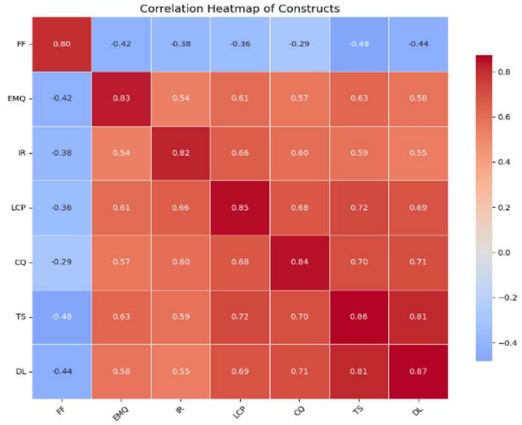

Figure 1. Correlation heatmap.

All constructs (FF, EMQ, IR, LCP, CQ, TS, DL) demonstrate strong factor loadings, which range from 0.77 to 0.89 (**Table 4**). This finding establishes complete convergent validity and internal consistency, together with accurate measurement model performance (**Figure 2**). However, the unrotated exploratory factor analysis showed that the first factor alone explains only 34.7% of the variance, which is less than the recommended value of 50%. Therefore, the common method variance did not pose a serious problem in the study because there were no dominant factors that explained the covariation among the measurement items.

The findings of the structural equation modelling (**Table 5**; **Figure 3**) give substantial evidence for all seven direct hypotheses. Tourist Satisfaction is negatively influenced by Failure Factors ($\beta = -0.21$, $p < 0.001$); thus, the survey results prove that perceived service or environmental failures decrease experiential evaluation. The effect size is not large, but it shows that operation and ecological failures in sustainable destinations have been reduced to the greatest extent possible. The significance of Environmental Management Quality and Infrastructure Resilience is also significant as the influence affecting Low-Carbon Practices is 0.34 and 0.41, respectively, and the p-value was less than 0.001. Infrastructure Resilience proves to be more influential, which means that adaptive transport systems, the use of renewable energy, and intelligent tourism infrastructure are at the heart of the perception of tourists towards the low-carbon implementation **Figure 2**.

Table 4. Discriminant validity matrix.

Construct	Item	Loading
FF	FF1	0.78
	FF2	0.82
	FF3	0.81
	FF4	0.77
EMQ	EMQ1	0.84
	EMQ2	0.86
	EMQ3	0.83
	EMQ4	0.82
IR	IR1	0.80
	IR2	0.84
	IR3	0.82
	IR4	0.79
LCP	LCP1	0.86
	LCP2	0.88
	LCP3	0.85
	LCP4	0.83
CQ	CQ1	0.84
	CQ2	0.87
	CQ3	0.82
	CQ4	0.85

Table 4. (*Continued*).

Construct	Item	Loading
TS	TS1	0.88
	TS2	0.86
	TS3	0.87
	TS4	0.85
DL	DL1	0.89
	DL2	0.88
	DL3	0.87
	DL4	0.86

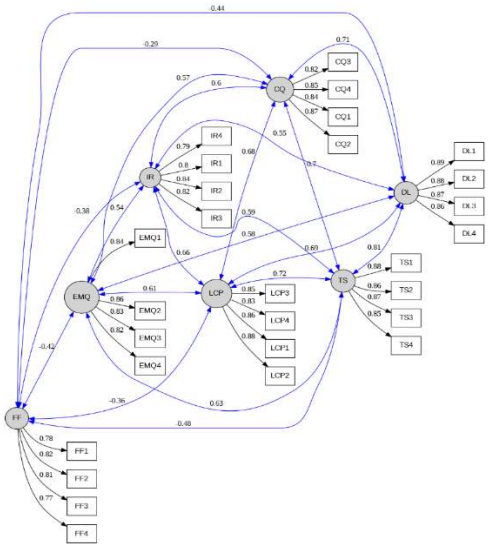

Figure 2. Measurement model with factor loadings.

Table 5. Hypothesis testing (standardized estimates).

Hypothesis	Path	β	S.E.	C.R.	p-value
H1	FF → TS	-0.21	0.05	-4.32	<0.001
H2	EMQ → LCP	0.34	0.06	6.01	<0.001
H3	IR → LCP	0.41	0.05	7.44	<0.001
H4	LCP → TS	0.36	0.05	6.98	<0.001
H5	CQ → TS	0.29	0.05	5.73	<0.001
H6	TS → DL	0.55	0.04	10.82	<0.001
H7	CQ → DL	0.24	0.05	4.88	<0.001

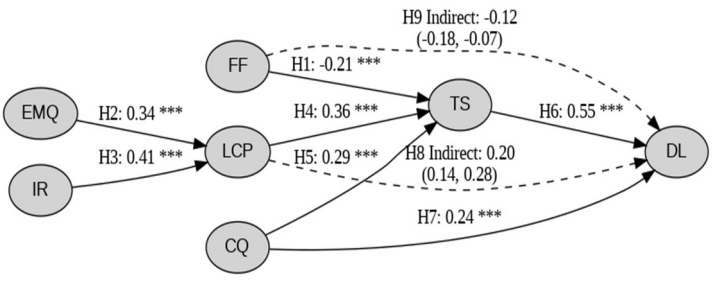

Figure 3. Pathway diagram.

Tourist Satisfaction ($\beta = 0.36$, $p < 0.001$) has been substantially increased by the Low-Carbon Practices, which proves that the perceived sustainability efforts have a positive effect on the experience of the tourist. This implies that tourists do not just appreciate sustainability on a shallow level but positively when the greener practices are concrete and incorporated in the service environment. Tourist Satisfaction is also largely dependent on the Quality of Communication ($\beta = 0.29$, $p < 0.001$). Good sustainability messages, openness and online communication thus reinforce experience perceptions. Notably, the strongest direct impact on Destination Loyalty is on Tourist Satisfaction ($\beta = 0.55$, $p < 0.001$), and satisfaction has been found as the most influential factor in predicting revisit intention and advocacy behaviour. Destination Loyalty is also directly influenced by the Quality of communication ($\beta = 0.24$, $p = 0.001$), which implies that, besides the increase in satisfaction, communication significantly increases long-term commitment.

The mediation analysis (**Table 6**) also explains the process by which resilience determines loyalty. There is a significant indirect effect of Low-Carbon Practices on Destination Loyalty via Tourist Satisfaction (indirect effect = 0.20), which is indicative of partial mediation. This proves that loyalty mainly comes as a result of sustainability programs aimed at increasing satisfaction. Likewise, the negative impact of Failure Factors on loyalty consists of the negative influence of satisfaction (indirect effect = -0.12), indicating that the negative effect of failures is mediated by dissatisfaction. The findings place Tourist Satisfaction in the middle of the psychological routes connecting the operational conditions and long-term behavioural intentions.

Table 6. Hypothesis testing (standardized estimates).

Hypothesis	Indirect Path	Indirect Effect	95% CI
H8	LCP → TS → DL	0.20	(0.14, 0.28)
H9	FF → TS → DL	-0.12	(-0.18, -0.07)

There is good overall structural validity of the model fit indices (**Table 7**). The value of the χ 2/df ratio of 2.41 is much less than the significant value of 3.0, which shows that the model is accepted as being simple enough. CFI (0.948) and TLI (0.941) are above recommended values, which illustrate a strong comparative fit of the model. The values of RMSEA (0.048) and SRMR (0.043) are shown to be excellent residual fit, and it shows that the hypothesized relationships are very close to the observed data. The model has a high empirical adequacy.

Table 7. Model fit indices (measurement + structural model).

Fit Index	Value
χ^2/df	2.41
CFI	0.948
TLI	0.941
RMSEA	0.048
SRMR	0.043
GFI	0.917

The multi-group SEM results (**Table 8**) indicate that Failure Factors negatively influence Tourist Satisfaction across all three provinces, with Phuket showing the strongest effect ($\beta = -0.22$, $p < 0.001$), highlighting tourists' sensitivity to service or environmental shortcomings. Low-Carbon Practices and Communication Quality create positive effects on customer satisfaction, which leads to greater Destination Loyalty, where Chiang Mai shows the strongest connection between LCP and customer satisfaction ($\beta = 0.42$, $p < 0.001$). Tourist Satisfaction consistently emerges as the strongest predictor of loyalty across provinces ($\beta \approx 0.60$–0.62, $p < 0.001$), confirming its mediating role. The results demonstrate that tourist loyalty requires both resilient low-carbon practices and effective communication, which can sustain loyalty even when services fail.

Table 8. Multi-group SEM comparison – direct effects on tourist satisfaction (TS) and destination loyalty (DL).

Predictor	Model 1: Zhejiang (Bangkok) β (SE)	Model 2: Phuket β (SE)	Model 3: Hunan (Chiang Mai) β (SE)
Intercept (TS)	0.31 (0.05) ***	0.29 (0.05) ***	0.28 (0.05) ***
Failure Factors (FF → TS)	−0.19 (0.06) **	−0.22 (0.05) ***	−0.20 (0.06) **
Low-Carbon Practices (LCP → TS)	0.42 (0.07) ***	0.37 (0.06) ***	0.35 (0.06) ***
Communication Quality (CQ → TS)	0.30 (0.06) ***	0.27 (0.05) ***	0.26 (0.05) ***
Infrastructure Resilience (IR → TS)	0.25 (0.05) ***	0.22 (0.05) ***	0.21 (0.06) **
Tourist Satisfaction (TS → DL)	0.62 (0.05) ***	0.60 (0.04) ***	0.59 (0.05) ***
Low-Carbon Practices (LCP → DL)	0.20 (0.06) **	0.18 (0.05) **	0.17 (0.06) **
Communication Quality (CQ → DL)	0.12 (0.05) *	0.13 (0.05) *	0.11 (0.05) *
FF → DL (Indirect via TS)	−0.12 (0.04) ***	−0.13 (0.04) ***	−0.12 (0.04) ***
LCP → DL (Indirect via TS)	0.26 (0.06) ***	0.23 (0.05) ***	0.22 (0.06) ***

*** $p < 0.001$

All in all, the major findings indicate that strong infrastructure and environmental governance greatly reinforce the perceived low-carbon practices, which consequently improve tourist satisfaction and loyalty. Quality of communication comes out as both a direct and indirect influence on loyalty, which highlights the strategic value of open sustainability communication. The effect of failure factors, though it exists, has a rather moderate negative impact, which indicates that the mechanism of resilience of the chosen destinations in Thailand is generally effective.

The most significant predictor within the model is the Tourist Satisfaction, which focuses on the importance of the fact that sustainability strategies have eventually resulted in positive experiences to gain long-term loyalty. The operational visibility of the smart and adaptive systems is shown not to affect sustainability perceptions unless enhanced by the effect of infrastructure resilience, which seems to have a stronger impact on the environmental management itself. Moreover, communication not only acts as informational support, but it is also a strategic mechanism of trust-building.

3.2. Thematic analysis results

Research used qualitative methods to gather data through 30 semi-structured interviews, which took place in the Bangkok, Phuket, and Chiang Mai in Thailand. Thematic analysis followed Braun and Clarke's six-step procedure, which includes familiarization and coding, theme development, review and refinement. The study

identified four main themes, which included (1) Perceived Service and Environmental Failure, (2) Visible Low-Carbon Adaptation and Infrastructure Resilience, (3) Communication Transparency and Trust Formation and (4) Satisfaction as a Pathway to Long-Term Loyalty. The themes provide an essential framework for understanding the quantitative SEM results, and they demonstrate how tourists mentally and emotionally experience resilience in low-carbon tourism systems.

3.2.1. Theme 1: Perceived service and environmental failure

The participants defined failure as a critical service disruption which destroyed the destination's sustainable reputation. The tourists who visited Bangkok identified two major problems which included Heritage zone overcrowding and Riverfront area congestion during peak season and the city's poor waste management system. The domestic visitor stated that "The city promotes green tourism but during festivals the streets become overcrowded and waste bins overflow. The claims of sustainability appear less genuine to me." The participants from Chiang Mai expressed their worries about temporary air pollution problems and traffic jams that disrupt access to both natural resources and cultural heritage areas. An international tourist noted, "The mountain scenery is beautiful, but when transportation is delayed and air quality drops, it reduces the experience." Environmental protection measures must remain active throughout all phases of sustainable tourism operations. The visitors to Phuket observed that the island's environmental protection laws for coastal areas were not being enforced in a consistent manner. One respondent stated, "The island promotes eco-friendly tourism, but I still saw plastic waste along some beaches. Effective monitoring needs to accompany promotion efforts because promotion by itself fails to achieve results." The tourists identified three problems which included environmental degradation, infrastructure strain, and overcrowding as reasons to question how well the destination could maintain its sustainable development goals.

3.2.2. Theme 2: Visible low-carbon adaptation and infrastructure resilience

Participants tracked their progress through three Thai destinations while recognizing their existing weaknesses. Bangkok residents reported three public transport developments which included electric systems and riverboat enhancements and digital ticketing systems. A participant declared that electric buses together with QR-based systems demonstrate the city's commitment toward intelligent sustainable tourism. The system demonstrates modernity while maintaining environmental protection. Phuket visitors showed strong interest in renewable energy use by resorts which achieved eco-certifications. A visitor said "Our hotel displayed its carbon-reduction initiatives and renewable energy use. The hotel showed me all its sustainability programs which made me trust their environmental initiatives more." Chiang Mai visitors received positive feedback about two environmental programs which included controlled visitor access to natural parks and eco-friendly shuttle systems. One tourist reported that "Battery-operated transport and regulated entry systems help protect the environment while still allowing tourism activities." These visible low-carbon practices functioned as resilience mechanisms. Tourists viewed green technologies together with adaptive infrastructure as proof of operational renewal and system-wide change.

3.2.3. Theme 3: Communication transparency and trust formation

Communication quality emerged as a central factor in building trust and emotional reassurance. The people of Bangkok appreciated digital information boards which provided real-time updates during service disruptions. Visitor feedback described how clear announcements and app notifications reduced frustration during our river cruise delays. “Phuket hotels and public spaces implemented sustainability programs which demonstrated their commitment to water conservation and renewable energy usage.” The resort clearly explained their environmental impact reduction methods. “This transparency increased his trust. The resort clearly explained how they minimize environmental impact. That openness strengthened my trust,” reported a respondent. Tourists in Chiang Mai used mobile applications which tracked crowd density and provided information about alternative travel routes. “The tourism app alerted us about busy areas and suggested less crowded paths which showed responsibility toward both visitors and the environment” according to a participant. Transparent and timely communication methods established operational connections which improved visitor satisfaction at all sites. Accurate information delivered at the right moment enhanced perceptions of accountability and preventive management.

3.2.4. Theme 4: Satisfaction as a pathway to long-term loyalty

The final theme used environmental responsibility and infrastructure efficiency together with communication transparency to determine complete customer satisfaction. A participant in Bangkok stated, “I am satisfied because sustainability exists throughout the entire experience which I found more attractive than everything else. I would revisit.” People who visited Phuket developed loyalty because they thought their eco-conscious identity connected to their preferred travel destinations: “I feel like a responsible traveler when I select a low-carbon island destination. I have recommended Phuket to friends who value sustainable tourism.” In Chiang Mai, satisfaction translated into advocacy behavior: “The balance between conservation and tourism development impressed me. I shared my experience online and plan to return.” Satisfaction formed the emotional foundation which connected resilience activities in all three Thai locations. The organization maintained its overall experience when customers could see low-carbon initiatives and staff members communicated service problems in an open manner. The organization achieved its goal to develop customer loyalty through adaptive responses which strengthened long-term loyalty intentions.

3.2.5. Synthesis of themes

The four themes together create a dynamic resilience framework. The first sustainability failure factors create cognitive dissonance, which people experience when they hear sustainability claims. The combination of visible low-carbon adaptation and strong infrastructure resilience protects against negative public perceptions. Transparent communication allows organizations to turn potential customer dissatisfaction into trust, which they maintain through customer satisfaction assessment. The qualitative findings support the SEM results because they demonstrate how organizations use resilience and communication mechanisms to develop their operational functions and handle their symbolic and emotional roles in building competitiveness. Thailand is developing its low-carbon tourism system, so this study examines how organizations use their communication capabilities to build

competitive advantages.

4. Discussion

The results of this research present a holistic approach to understanding how resilient tourism systems affect tourist satisfaction and destination loyalty in the context of sustainability over the long term in Thailand. Through the use of operationalization of resilience in terms of failure management, low-carbon, infrastructure resilience, and quality of communication, the researchers prove that sustainable development in tourism cannot be achieved only through environmental practices but requires the joint impact of operational performance, social trust, and visitors' perceptions. As shown by descriptive statistics, tourists hold quite positive attitudes towards sustainable tourism systems in Bangkok, Phuket, and Chiang Mai. Particularly, Destination Loyalty (Mean = 3.88, SD = 0.64) and Tourist Satisfaction (Mean = 3.85, SD = 0.61) had the highest scores among all variables, showing that tourists hold positive attitudes towards sustainability-oriented tourism initiatives and are ready to act according to these perceptions through positive recommendations and revisit intentions.

While the failure factors category had a relatively modest mean score (Mean = 3.02), this finding must be critically analyzed and interpreted. The findings based on qualitative data indicated that overcrowding, pollution, inconsistent application of environmental policies, and occasional service delays were important challenges for tourists. However, the rather modest statistic score implies that such factors might not have been consistent or impactful enough to significantly impair tourists' experiences in their entirety. The presence of contradiction between "moderate" scores obtained via statistics and the narrative of "critical service disruption" described in the qualitative part suggests that tourists can differentiate between the impact of operational difficulties and resilience capacity of the destination. It means that it is possible to use management approaches that can ensure resilience capability without making it noticeable to tourists. Thus, resilience can be seen as an aspect of management practice and perception. Recovery mechanisms, adaptation techniques, and environmental policies can minimize impacts of possible problems, ensuring that service failures cannot negatively affect the experience of tourists and cause them harm [29].

The results of the structural equation modeling reveal that Failure Factors affect Tourist Satisfaction negatively (β = -0.21, $p < 0.001$), whereas Low-Carbon Practices (β = 0.36, $p < 0.001$) and Communication Quality (β = 0.29, $p < 0.001$) strongly increase Tourist Satisfaction [30]. Such results indicate that resilience in tourism is a multi-dimensional phenomenon, where factors of environmental sustainability, operational efficiency, and communication quality altogether form psychological evaluations of the destination experience [31]. The negative effect of failures on tourist satisfaction was statistically significant but relatively weak, which means that the tourism destinations in Thailand have made considerable progress in addressing operational and environmental challenges through resilience-based adaptation. Such findings are consistent with other studies indicating that environmental stressors, including overcrowding at a destination site, may decrease visitor satisfaction unless

offset by the efficient management of destination activities [32]. Likewise, low-carbon efforts, such as the adoption of renewable energy technologies, sustainable transportation networks, and ecological infrastructures, positively impact visitors' perceptions of destination quality and decision-making processes [33].

Most importantly, while discussing failure management, one should not narrow down the analysis only to operational factors since social bonding and communicational processes affect tourist attitudes in terms of their recovery [34]. According to the findings, clear communication, responsiveness, and cultural sensitivity could reduce the adverse effects associated with service failures. In this context, it has been stated that according to Sangperm and Pungpho [35], communication serves as a crucial instrument which connects social bonding to customer satisfaction and loyalty development. The authors emphasize the role of relationship-building practices in cases when service delivery faces certain difficulties as the elements of trust and emotional bond will help to make up for those imperfections. Thus, this approach makes the theoretical explanation provided above more solid in relation to Research Question 3 as the factor of resilience cannot be considered solely technological.

Qualitative evidence lends strong support to the above interpretation. Many tourists identified effective communication systems, mobile phone apps, digital signs, and updates by the hotel administration and municipal officials as reasons that bolstered their trust and confidence in uncertain times. Communication therefore played not only a role in information transfer but also in providing emotional comfort and bonding experiences. These results align with previous research that stressed the importance of quality communication as being essential to improving customer satisfaction and mediating the influence of service quality on customer loyalty [33,34]. In addition, the direct impact of Communication Quality on Destination Loyalty ($\beta = 0.24$, $p < 0.001$) implies that quality and promptness can maintain loyalty even in the presence of malfunctioning operations. A combined framework of communication and bonding therefore offers a richer understanding of resilience systems in tourism settings.

On the other hand, there is need to understand the human and service aspects of low-carbon tourism destinations along with infrastructure sustainability. The tourism destinations of Bangkok and Phuket attract international tourists who come from various segments across the globe, and their perception of service quality may differ based on their cultural expectations and communication practices. In this respect, Sriboonlue [36] stated that cultural factors play an important role in shaping service quality perceptions, customer interactions, satisfaction, and loyalty in multinational service industries. From the standpoint of this research, there is a possibility that communication practices and resilience measures could be viewed differently by tourists from different cultural backgrounds. While some tourists might appreciate the efficient provision of services, other tourists may focus on empathy or communication. Therefore, resilience practices need to embrace communication techniques that align with cultures.

Similarly, the shift from satisfaction to destination loyalty over time can be well explained using the construct of destination attachment. Mediation analysis indicated that Tourist Satisfaction serves as an important psychological mediator between

operational resilience and destination loyalty. Specifically, Low-Carbon Practices had a positive indirect impact on Destination Loyalty through Tourist Satisfaction (indirect effect = 0.20), whereas Failure Factors had a negative indirect impact (indirect effect = -0.12). Based on these results, sustainability practices affect loyalty not only through improving environmental conditions but also through fostering emotional ties with and positive identification of destinations. This view is consistent with the study by Panthurat et al., who noted that creative tourism experiences and service marketing have a significant impact on tourists' intentions through developing destination attachment [37].

In light of sustainable development, the current study provides significant contributions to the achievement of SDGs 8 (Decent Work and Economic Growth), 12 (Responsible Consumption and Production), 13 (Climate Action), and 16 (Peace, Justice, and Strong Institutions). Examples of investments made in renewable energy, low-carbon transportations, eco-certifications, and governance practices show how it is possible to make sustainability and competitiveness of the environment go hand-in-hand. In addition to providing theoretical contributions, the findings of this study also have important practical implications for destination management and policy-makers from various countries, including Thailand and other Southeast Asia countries. The key take-away point from the findings of this study is the necessity to invest in building low-carbon transportations, communicative systems that are sensitive to local culture, as well as mechanisms for monitoring and enhancing service quality to sustain tourists' satisfaction and loyalty. On the downside, the current study suffers from several limitations: geographic focus of the study limited to three destinations, cross-sectional design, and self-reported data.

5. Conclusion

The research shows that low-carbon tourism systems which demonstrate resilience bring about two benefits for Thailand which include increased tourist satisfaction and permanent visitor loyalty to the country. The study shows that three factors which include Low-Carbon Practices and Infrastructure Resilience and Communication Quality lead to higher customer satisfaction which results in increased customer loyalty. The study shows that Tourist Satisfaction functions as the main psychological link which connects system performance to user behavior because it shows how resilience and expectation-confirmation processes work together in sustainable tourism systems.

Implications

The research provides both theoretical and practical benefits to its readers. The research develops existing literature through its theoretical framework which combines resilience theory with failure management and communication components to create a complete framework which solved previous research problems. The research study demonstrates that destination managers must direct their efforts toward active low-carbon projects through their spending on intelligent infrastructure which should include public access to current operational data. The visitor experience improves through these efforts which support sustainability objectives that include SDGs 8 and 12 and 13 and 16.

Limitations

The study presents multiple research constraints which impact its overall results. The researchers conducted their data collection during peak tourism periods which prevented them from observing complete tourist perception changes throughout different times. Survey responses depend on participants honesty but self-reported survey data creates problems because people tend to answer questions in ways they think researchers want to see. The research study focused on three Thai tourist locations which together established a research boundary that restricted its results to those particular sites. The cross-sectional research approach prevents researchers from establishing permanent cause-and-effect links between different variables.

Future research directions

The development of tourist perception research should use longitudinal approaches in future studies to investigate how these attitudes develop across different seasons. The study will achieve better generalizability through its expansion to international research areas which include various research settings. Sustainable tourism systems will benefit from further research which will investigate how cultural differences and digital experience quality and crisis-specific resilience strategies impact their operations

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Informed consent statement: Informed Written consent was obtained from all participants prior to data collection.The use of written consent was approved by the Institutional Ethics Committee to reduce participant burden and to ensure respondent anonymity, in accordance with institutional and ethical guidelines.

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References

1. Seraj M, Ike OC, Ozdeser H. The contribution of tourism to GDP growth and sustainable tourism development in Africa. Future Business Journal. 2025; 11(1): 115. doi: 10.1186/s43093-025-00532-8
2. Alexandre R, Diaz MD. Tourism receipts, employment, and infrastructure: Drivers of Brazil's economic growth. Journal of Policy Options. 2025; 8(3): 45–55. doi: 10.5281/zenodo.17315176
3. Petrosillo I, Zurlini G, Grato E, Zaccarelli N. Indicating the fragility of socio-ecological tourism-based systems. Ecological Indicators. 2006; 6(1): 104–113. doi: 10.1016/j.ecolind.2005.08.008
4. Tu J, Luo S, Yang et al. Spatiotemporal evolution and the influencing factors of tourism-based social-ecological system vulnerability in the Three Gorges Reservoir Area, China. Sustainability. 2021; 13(7): 4008. doi: 10.3390/su13074008
5. Holden A. Local tourism governance: Issues of equity and justice in the use of nature. In: Tourism Governance in the

Anthropocene. 2025: 11–31. doi: 10.1007/978-3-031-95697-3_2
6. Carreira H, Ferreira JJ. Environmental resilience and carbon neutrality: A systematic and integrative review. Management of Environmental Quality: An International Journal. 2025: 1–29. doi: 10.1108/MEQ-06-2025-0404
7. Guo Y, Li S. Multi-level governance of low-carbon tourism in rural China: Policy evolution, implementation pathways, and socio-ecological impacts. Frontiers in Environmental Science. 2025; 12: 1482713. doi: 10.3389/fenvs.2024.1482713
8. Zhang J. Determinants of tourism enterprises' low-carbon transition: Seen from the strategy tripod perspective. Journal of Sustainable Tourism. 2025: 1–28. doi: 10.1080/09669582.2025.2573702
9. Zhu Y, Chai S, Chen J, Phau I. How was rural tourism developed in China? examining the impact of China's evolving rural tourism policies. Environment, Development and Sustainability. 2024; 26(11): 28945–28969. doi: 10.1007/s10668-023-03850-5
10. Wang X, Zhang M, Jie S, et al. Exploring the coordinated evolution mechanism of regional sustainable development and tourism in China's "Beautiful China" initiative. Land. 2023; 12(5): 1003. doi: 10.3390/land12051003
11. Peeters P, Eijgelaar E. Low-carbon tourism. In: Encyclopedia of Tourism. Springer Nature Switzerland; 2025: 626–627. doi: 10.1007/978-3-319-01384-8_278
12. Kusumah EP. Sustainable tourism concept: Tourist satisfaction and destination loyalty. International Journal of Tourism Cities. 2024; 10(1): 166–184. doi: 10.1108/ijtc-04-2023-0074
13. Grigoriadis P, Salepaki A, Angelou I, Kourkouridis D. Risk and resilience in tourism: how political instability and social conditions influence destination choices. Tourism and Hospitality. 2025; 6(2): 83. doi: 10.3390/tourhosp6020083
14. Schweiggart N, Shah AM, Qayyum A, Jamil RA. Navigating negative experiences: how do they influence tourists' psychological and behavioural responses to tourism service failures on social media? Asia Pacific Journal of Tourism Research. 2025; 30(6): 786–808. doi: 10.1080/10941665.2025.2471492
15. Chen CF, Chen FS. Experience quality, perceived value, satisfaction and behavioral intentions. Tourism Management. 2010; 31(1): 29–35. doi: 10.1016/j.tourman.2009.02.008
16. Chen X, Cheng ZF. The impact of environment-friendly short videos on consumers' low-carbon tourism behavioural intention: A communicative ecology theory perspective. Frontiers in Psychology. 2023; 14: 1137716. doi: 10.3389/fpsyg.2023.1137716
17. Lee TH, Jan FH, Yang CC. Conceptualizing and measuring environmentally responsible behaviors. Tourism Management. 2013; 36: 454–468. doi: 10.1016/j.tourman.2012.09.012
18. Han H, Yu J, Kim W. Youth travelers and waste reduction behaviors while traveling to tourist destinations. Journal of Travel & Tourism Marketing. 2018; 35(9): 1119–1131. doi: 10.1080/10548408.2018.1435335.
19. Platania M. Resilience frameworks in tourism studies: A literature review. Turistica-Italian Journal of Tourism. 2023; 32(1): 1–44. doi: 10.70732/tijt.v32i1.16
20. Prayag G. Symbiotic relationship or not? Understanding resilience and crisis management. Tourism Management Perspectives. 2018; 25: 133–135. doi: 10.1016/j.tmp.2017.11.012
21. Becken S. Decarbonising tourism: mission impossible? Tourism Recreation Research. 2019; 44(4): 419–433.
22. Liang L, Peng KL. The influence of the carbon neutrality goal on tourists' low-carbon tourism behavior intention in space tourism. Explora: Environment and Resource. 2025; 2(1): 3655. doi: 10.36922/eer.3655
23. Bhat MA. Tourism service quality: A dimension-specific assessment of SERVQUAL. Global Business Review. 2012; 13(2): 327–337. doi: 10.1177/097215091201300210
24. Kim H, Fesenmaier DR. Persuasive design of destination web sites: An analysis of first impression. Journal of Travel Research. 2008; 47(1): 3–13. doi: 10.1177/0047287507312405
25. Oliver RL. A cognitive model of the antecedents and consequences of satisfaction decisions. Journal of Marketing Research. 1980; 17(4): 460–469. doi: 10.1177/002224378001700405
26. Chen CF, Chen FS. Experience quality, perceived value, satisfaction and behavioral intentions. Tourism Management. 2010; 31(1): 29–35. doi: 10.1016/j.tourman.2009.02.008
27. Yoon Y, Uysal M. An examination of the effects of motivation and satisfaction on destination loyalty. Tourism Management. 2005; 26(1): 45–56. doi: 10.1016/j.tourman.2003.08.016
28. Prayag G, Ryan C. Antecedents of tourists' loyalty to Mauritius: The role and influence of destination image, place attachment, personal involvement, and satisfaction. Journal of Travel Research. 2012; 51(3): 342–356. doi: 10.1177/0047287511410321
29. Hu Y, Xu S. Repeat tourists' perceived unfavourable changes and their effects on destination loyalty. Tourism Review. 2023; 78(1): 42–57. doi: 10.1108/TR-05-2022-0235

30. Phi LN, Phuong DH, Huy TV. How perceived crowding changes the interrelationships between perceived value, tourist satisfaction and destination loyalty: The empirical study at Hoi An. International Journal of Tourism Cities. 2024; 10(1): 324–352. doi: 10.1108/IJTC-08-2023-0155
31. Janchai N, Suvittawat A. The structural equation model of factors affecting decision-making on low-carbon tourist destinations. Sustainability. 2025; 17(5): 2082. doi: 10.3390/su17052082
32. Wei C, Zhang T. Authenticity and quality of industrial heritage are the drivers of tourists' loyalty and environmentally responsible behavior. Sustainability. 2023; 15(11): 8791. doi: 10.3390/su15118791
33. Nguyen HKT, Tran PTK, Tran VT. The relationships among social media communication, brand equity and satisfaction in a tourism destination: the case of Danang city, Vietnam. Journal of Hospitality and Tourism Insights. 2024; 7(2): 1187–1210. doi: 10.1108/jhti-11-2022-0567
34. Arabacıoğlu D, Dedeoglu BB. The moderating role of information quality in the relationship between guides' communication skills and tour satisfaction. Journal of Quality Assurance in Hospitality & Tourism. 2025; 26(4): 813–832. doi: 10.1080/1528008X.2023.2264510
35. Sangperm N, Pungpho K. Exploring the nexus between bonding, communication, customer satisfaction and customer loyalty: A case of higher education institutes in Thailand. Asian Administration & Management Review. 2020; 3(2): 25–38. doi: 10.2139/ssrn.3888066
36. Sriboonlue U. The effects of cultural dimensions on service quality, customer engagement, customer satisfaction and customer loyalty in multi-national airline sectors. Asian Administration & Management Review. 2022; 5(2): 12–23.
37. Panthurat M, Chimpleewat K, Lalaeng C. driving tourist intentions via creative tourism, service marketing, and destination attachment. Asian Interdisciplinary and Sustainability Review. 2026; 15(1): 4–4. doi: 10.14456/aisr.2026.4