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The Impact of Perceived Value, Social Norms, Destination Context and Psychological Ownership on Low-Carbon Tourism Behaviour in Chinese Rural Tourism

Luqin Zhu **, *Chonlavit Sutunyarak*** *

Chakrabongse Bhuvanarth International College of Interdisciplinary Studies, Rajamangala University of Technology Tawan-ok, Bangkok 10400, Thailand

ABSTRACT

This study aims to identify the factors influencing low-carbon tourism behaviour among visitors to China's rural tourism destinations; empirically examine the elements affecting such behaviour; and develop a model to promote low-carbon tourism behaviour among rural visitors and provide practical guidance for implementation. A questionnaire survey was conducted among visitors to the ancient villages of Xidi and Hongcun (a UNESCO World Heritage site) in southern Anhui Province. Empirical analysis was performed on 620 valid questionnaires collected. Through CFA and SEM, a model for low-carbon tourism behaviour was constructed and validated. Low-carbon tourism destination context, perceived value of low-carbon tourism, social norms, and psychological ownership all exerted positive influences on low-carbon tourism behaviour. Psychological ownership served as a mediating factor. Among these, the low-carbon tourism destination context emerged as the most significant influencing factor. The model explains 60.4% of the variance in the dependent variable of low-carbon tourism behaviour (R^2 = 0.604), demonstrating excellent explanatory power. In the sustainable development of low-carbon rural tourism, governments, communities and tourism enterprises should establish comprehensive measures encompassing the creation of low-carbon environments in rural

*CORRESPONDING AUTHOR:
Chonlavit Sutunyarak, Chakrabongse Bhuvanarth International College of Interdisciplinary Studies, Rajamangala University of Technology Tawan-ok, Bangkok 10400, Thailand; Email: chonlavit_su@rmutto.ac.th

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tourism destinations, enhancing travellers' perception of low-carbon tourism value, social norms and psychological ownership. Future research is recommended to expand case studies and explore other potential influencing factors.

Keywords: Low-Carbon Tourism Behaviour; Low-Carbon Tourism Destination Context; Perceived Value of Low-Carbon Tourism; Social Norms; Psychological Ownership

1. Introduction

With the rapid advancement of the global industrial economy and the continuous growth of the world's population, the global economic landscape has experienced substantial development. Human society now confronts a series of adverse consequences stemming from this progress. The excessive exploitation of natural resources and the discharge of vast quantities of waste have subjected the Earth to numerous environmental challenges [1], including global warming and an intensified greenhouse effect. These environmental challenges not only impede sustainable development and economic growth across nations but also pose severe threats to human health and safety [2].

Since the 1990s, nations worldwide have progressively recognised environmental protection as a pressing reality, with sustainable development emerging as a global consensus. Tourism's carbon emissions have also drawn increasing international attention, transforming the sector's former image as a ‘smokeless industry’. As greenhouse gas emissions from tourism operations become increasingly prominent, research indicates the industry accounts for a significant proportion of global greenhouse gas emissions, emerging as a key driver of global climate change [3]. According to the International Energy Agency (IEA) report, global carbon dioxide emissions reached 37.4 billion t in 2023, with tourism accounting for approximately 6.5% [4]. The relationship between tourism and the ecological environment is profoundly intertwined, with both mutually influencing and complementing each other [5]. The development of tourism relies fundamentally on the ecological resources of destinations, which serve as key attractions and are central to their competitiveness. In recent years, escalating pollution, substantial waste discharge, ecological resource degradation, and species decline have intensified, with environmental challenges increasingly evident across numerous tourist destinations. This threatens the sustainable development of tourism [6]. Consequently, advancing low-carbon tourism has become pivotal for both environmental conservation and the industry's sustainable growth. Tourists are directly linked to tourism sector carbon emissions, as tourism activities are fundamentally driven by tourist demand. Tourist activities during travel—including dining, accommodation, transportation, sightseeing, shopping, and entertainment—are intrinsically connected to energy consumption and carbon emissions [7]. Consequently, the key to achieving low-carbon tourism lies in promoting low-carbon tourism behaviour among tourists [8].

Low-carbon tourism behaviour refers to travellers adopting low-carbon lifestyles and consumption patterns during tourism activities, thereby reducing carbon emissions and protecting the ecological environment of tourist destinations [9]. Research into the influencing factors of low-carbon tourism behaviour has primarily focused on two aspects: rational factors and non-rational factors. Existing studies indicate that rational cognitive factors significantly influence individuals' environmental protection behaviour [10]. These encompass both external objective contextual factors and internal individual cognitive factors. External contextual factors include cost-benefit considerations, social norms, destination characteristics, policy regulations, environmental ambience, and accessibility of low-carbon information. Individual cognitive factors such as environmental attitudes, personal capability characteristics and external circumstances exert a significant influence on an individual's responsible environmental behaviour. In recent years, scholars within the tourism field have begun examining the influence and mechanisms of non-rational factors on travellers' low-carbon tourism behaviour within tourism contexts. Findings indicate that affective emotional factors better explain and predict travellers' low-carbon tourism behaviour than rational factors. Building upon this, scholars have integrated knowledge from disciplines such as psychology and sociology into tourism research to explore additional irrational factors influencing travellers' low-carbon tourism behaviour. Irrationality primarily re-

fers to affective factors, including attitudes, satisfaction, place attachment and psychological ownership.

Although prior research has examined specific factors influencing low-carbon tourism behaviour, such as attitudes, values, and social norms, few studies have investigated the determinants of travellers' low-carbon tourism behaviour from the perspective of an integrated rational-irrational framework. Existing research on the relationship between psychological ownership and individual emotional attachment or behavioural intention has primarily been conducted within marketing and psychology disciplines, with limited exploration in the tourism field.

The Cognitive-Affective-Behavioral (CAB) Theory posits a hierarchical and progressive relationship among cognition, emotion, and behavior. After receiving information and knowledge, individuals form specific cognitive structures. These cognitions trigger corresponding emotional responses, which in turn drive behavioral decisions. The CAB theory offers an integrated perspective for interpreting human psychology and behavior. This theory has been widely applied in consumer and social studies.

Therefore, this paper adopts the CAB theory as its fundamental research framework. Drawing upon existing academic research and considering the characteristics of low-carbon tourism activities, it examines the case study of the Ancient Villages in Southern Anhui—Xidi and Hongcun, one of China's World Cultural Heritage sites. Utilising four structural variables—perceived value, social norms, low-carbon tourism context, and psychological ownership. This comprehensive structural model integrates both rational and non-rational factors influencing low-carbon tourism behaviour. Empirical research examines how these elements collectively shape tourists' low-carbon practices, analyzes their mediating effects, and proposes practical guidance strategies.

2. Review of Literature and Hypothesis Formulation

2.1. Perceived Value of Low-Carbon Tourism

The Value-Norm-Belief (VBN) Theory was proposed by Stern in 1999. This theory's central claim is that an individual's values, beliefs and norms together determine the individual's behaviour. The three variables interact with each other so that individuals with different values, beliefs, and norms behave differently and have different impacts on the environment [11]. The mechanisms and determinants of pro-environmental and altruistic behavior are explained by the VBN. Altruistic behavior requires adherence to personal ideals.

In the consumer field, perceived value is commonly used to explain and predict consumer preferences and purchasing decisions. Therefore, in the mid-1990s, scholars in the tourism field and destination managers also began to focus on tourists' perceived value to explain and predict tourists' travel preferences and decisions.

Academic conceptualizations of value perception can be categorised into single-dimensional and multi-dimensional approaches. Single-dimensional approaches measure tourists' value perception as their overall evaluation of the products and services experienced during the tourism process [12]. Multi-dimensional approaches, however, yield varying conclusions among scholars, including hypotheses such as the two-, three-, five-factor theories. The perceived value of low-carbon tourism was divided into two categories by Mei et al.: low-carbon value perception and emotional value perception [12]. This indicates that tourists' ecological values and altruistic values have a positive impact on their low-carbon behaviour.

Based on the above, this study hypothesises that:

H1. *Perceived value of low-carbon tourism positively influences low-carbon tourism behaviour.*

Value perception is widely regarded by scholars as an important antecedent variable of emotional evaluation and attitude, meaning that emotions and attitudes are influenced by customers' cognitive evaluations based on their initial perceptions of product or service performance [13]. Since environmental protection actions are public-interest activities, implementing low-carbon behaviours can be recognised and appreciated by the public, leading to higher social recognition. Such actions can gain higher social reputation, thereby endowing public environmental protection actions with the value of establishing a good reputation, enhancing their sense of meaning and control, and thus reinforcing psychological ownership [14].

Based on the above, this study hypothesises that:

H2. *Perceived value of low-carbon tourism positively influences psychological ownership.*

2.2. Social Norms

The Theory of Planned Behaviour (TPB) was proposed by Ajzen in 1991, used to explain and predict people's behaviors, and to examine the connection between behaviors and subjective psychological aspects. TPB posits subjective norms as one of the core variables explaining behavioural intentions. Its content structure comprises normative beliefs and compliance motives. Subsequently, scholars further supplemented TPB with the social norm dimension as a crucial variable, utilised to explain societal expectations and support for individual behaviour. Subjective norms are implicit within the core logic of social norms, representing the influence of reference groups and social pressure on specific individual behaviours. Cialdini et al. proposed the Norm Focus Theory, categorising social norms into two types: descriptive norms and injunctive norms. The former refers to what the majority 'actually do'; the latter denotes what society or the group deems 'should be done'[15].

Social norms are rules of behaviour that are accepted by the majority of people in a particular social group. Social norms represent the influence of external factors on individual behaviour. Individuals tend to engage in conduct that aligns with social norms to reduce the pressure arising from violating external normative beliefs. The greater the perceived external pressure, the stronger the force exerted by social norms. Conversely, the higher the perceived level of support for one's behaviour, the greater the likelihood of that behaviour being enacted.

Low-carbon tourism consumption behavior is encouraged by social norms, according to Tang et al.'s study of tourists' green consumption habits in rural tourist destinations using the TPB theory [16]. Han found that social moral norms and the social pressure they generate positively influence customers' choice of environmentally friendly green accommodation products [17].

Based on the above, this study hypothesises that:

H3. *Social norms positively influence low-carbon tourism behaviour.*

Han et al. found that when individuals perceive the requirements of social norms, their reward and punishment mechanisms prompt them to internalise the behaviours required by the norms. This enhances their sense of social recognition and belonging, and the norms endow their actions with meaning, thereby strengthening their psychological ownership. This leads individuals to feel like they own something, control, and responsibility derived from participation [18]. Therefore, in the collective-oriented context of rural tourism destinations, social norms significantly promote the formation of psychological ownership among tourists by providing reference group behaviour samples, behavioural scripts for destination norms, assigning meaning to behaviour, and enhancing the legitimacy of behaviour.

Based on the above, this study hypothesises that:

H4. *Social norms positively influence psychological ownership.*

2.3. Low-Carbon Tourism Destination Context

The Attitude-Context-Behaviour (ABC) theory was proposed by Guagnano et al. in 1995 [19]. It posits that an individual's attitudes and external contextual factors influence their behaviour, emphasising the impact of external circumstances on individual conduct and indicating that cognitive processes alone do not solely determine behaviour. When individual factors have little or no influence, external situational factors determine behaviour. When external environmental factors are unfavourable or favourable, individuals often choose whether to take action. If external conditions are unfavourable, such as high costs or high implementation difficulties, the influence of individual attitudes on behaviour weakens regardless of whether the attitudes are positive or negative; if external conditions are favourable, such as low costs or low implementation difficulties, individual attitudes have a greater positive influence on behaviour, thereby promoting its occurrence.

Tourism activities occur in a specific space and context, and the behaviour of tourists is inevitably influenced by external contextual factors [20]. A low-carbon environment is established by tourist attractions through measures such as offering low-carbon products and eco-friendly facilities, thereby fostering conditions conducive to the development of low-carbon tourism [21]. Yang categorises low-carbon scenarios in tourist destinations into two dimensions: low-carbon environment creation and low-car-

bon environmental education [22].

The creation of low-carbon scenarios at tourist destinations provides concrete operational conditions for travellers' low-carbon tourism behaviour [22]. It can be argued that the establishment of such low-carbon scenarios directly influences travellers' willingness to engage in low-carbon actions [23]. Numerous scholars have examined the influence of external contextual factors on individual environmental behaviour, consistently concluding that such factors exert either direct or indirect effects [9]. The development of low-carbon behaviour is inseparable from low-carbon environmental conditions. Based on the foregoing, this study hypothesises that:

H5. *Low-carbon tourism destination context positively influences low-carbon tourism behaviour.*

According to Pierce et al., when people get to know target things better, they progressively acquire psychological ownership over them. Touching a target product or mentally imagining touching it can promote the formation and enhancement of psychological ownership [24]. Baloglu found that the familiarity of tourists with destination-related information positively influences their perceived positivity and identification [25]. The low-carbon tourism environment provides the external objective conditions for establishing psychological ownership among travellers, with psychological ownership being underpinned by low-carbon environmental resources [23].

Based on the above, this study hypothesises that:

H6. *Low-carbon tourism destination context positively influences psychological ownership.*

2.4. Psychological Ownership

The concept of psychological ownership was first proposed by Pierce et al., initially applied primarily within organisational studies [26]. It denotes an individual's psychological perception that an object is “mine” or “ours”. Psychological ownership has found extensive application in consumer research, serving as a significant variable in consumer attitudes and behaviour, and has been empirically validated across diverse contexts [27]. Existing research primarily resides within organisational behaviour and product marketing domains, with few studies applying psychological ownership to tourist behaviour [28]. Tourist spaces are characterised by their foreignness, transience, and ephemerality. Tourists' identities become concealed, and the normative constraints of everyday life diminish, leading to shifts in individual psychology and behaviour. Given these distinctive features, the causal relationship between tourists' psychological ownership of destinations and environments and their subsequent behaviour remains unclear. Although some scholars have examined the effects of tourists' psychological ownership towards destinations or specific actions on willingness to pay, loyalty behaviour, environmental responsibility behaviour, and green tourism, research findings remain scarce [29].

Pierce et al. posited that psychological ownership comprises both cognitive and affective components. Its motivational origins stem from three sources: spatial ownership, self-efficacy, and self-identity [24]. Regarding the dimensions of psychological ownership, the marketing field tends to adopt Pierce's single-dimensional measurement approach [24]. Avey et al. subdivided psychological ownership into five dimensions: sense of responsibility, sense of self-efficacy, sense of ownership, sense of belonging, and sense of identification [30].

Studies by Preston et al. reveal that tourists' psychological ownership of destinations positively influences their subsequent low-carbon tourism practices and conservation of natural areas [31]. Compared to general environmental attitudes, travellers' attitudes towards specific physical environments exert a stronger influence on their behaviour within those particular settings. Consequently, travellers' positive attitudes towards low-carbon tourism in rural tourism contexts may predispose them to adop low-carbon tourism behaviours.

Based on the above, this study hypothesises that:

H7. *Psychological ownership positively influences low-carbon tourism behaviour.*

Research by Zhang and other scholars indicates that environmental knowledge exerts a positive influence on attitudes toward ecotourism. This enhances residents' sense of connection to ecological landscapes, thereby boosting their willingness to participate [32]. Hungerford and Volk posited that individuals receiving environmental education could heighten their environmental awareness, thereby in-

directly influencing environmental behaviour [33]. Perceived value of low-carbon tourism, social norms, and the destination's low-carbon environment can all enhance tourists' sense of responsibility and self-efficacy toward the destination and low-carbon environmental actions, thereby increasing psychological ownership. Therefore, these factors exhibit a symbiotic evolutionary relationship with psychological ownership and low-carbon tourism behavior.

Based on the above, this study hypothesises that:

H8. *Psychological ownership mediates the perceived value of low-carbon tourism and low-carbon tourism behavior.*
H9. *Psychological ownership mediates the social norms and low-carbon tourism behavior.*
H10. *Psychological ownership mediates the low-carbon tourism destination context and low-carbon tourism behavior.*

2.5. Conceptual Framework

This study's conceptual framework examines the interrelationships among five second-order latent constructs within low-carbon tourism: perceived value of low-carbon tourism (PV), social norms (SN), low-carbon tourism destination context (LC), psychological ownership (PO), and low-carbon tourism behaviour (LTB). Each second-order construct comprises multiple first-order dimensions: PV includes ecological values, emotional values, and social values; SN encompasses descriptive norms, prescriptive norms, and normative beliefs; LC comprises low-carbon environment creation, low-carbon environment education, and low-carbon economic incentives; PO comprises sense of belonging, sense of responsibility, and self-efficacy; LTB encompasses low-carbon tourism purchasing behaviour, reduction-based low-carbon tourism behaviour, and maintenance-oriented low-carbon tourism behaviour. This model aggregates multiple primary dimensions under a higher-order construct, systematically elucidating how perceived value, social norms, and low-carbon context influence tourists' low-carbon tourism behaviour (**Figure 1**).

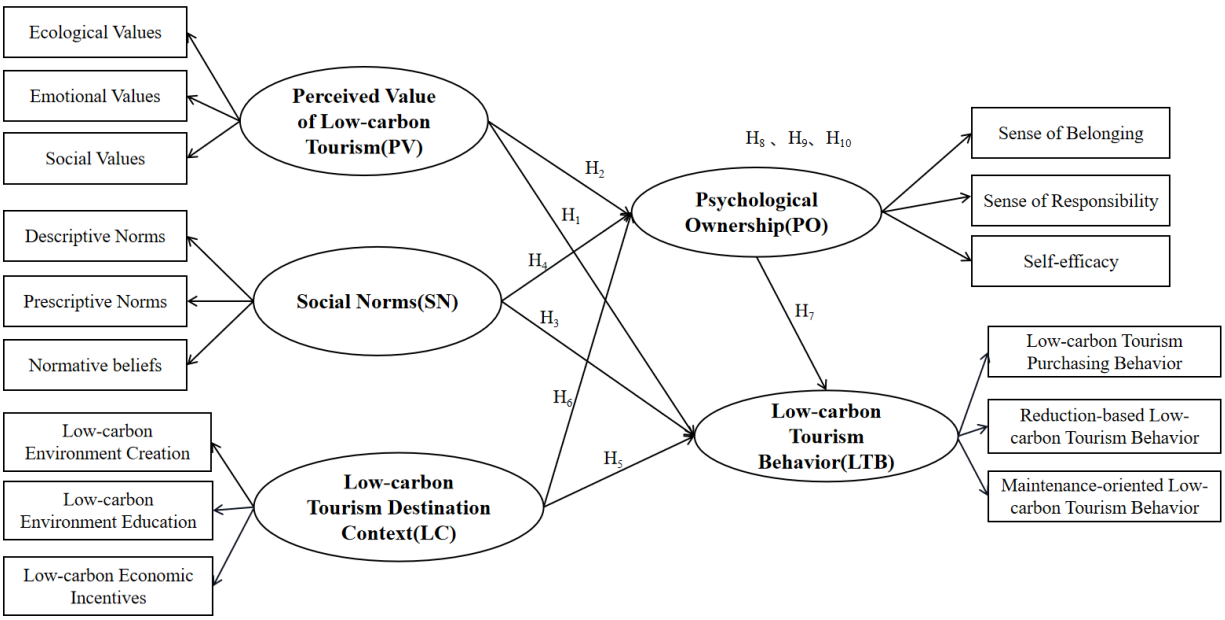

Figure 1. Conceptual Framework.

3. Materials and Methods

This study employs a quantitative research design to examine the relationships between PV, SN, LC, PO and LTB. Using a convenience sampling method, questionnaires were distributed to tourists at the main attractions of Xidi Village and Hongcun Scenic Area between 12th and 17th July 2025. Measurement items drew upon existing scales: perceived value of low-carbon tourism (PV) was assessed using the scale designed by Zhao et al. (2015) [9];

social norms (SN) employed the scale developed by Ma et al. (2024) [34]; low-carbon tourism destination context (LC) was measured using the scale designed by Liang and Kong (2021) [35]; psychological ownership (PO) was measured using the scale designed by Kumar and Nayak (2019) [36]; and low-carbon tourism behaviour (LTB) was measured using the scale designed by Mei (2023) [12]. Considering the contextual elements of rural low-carbon tourism, the wording should be adjusted to suit the rural tourism setting. For instance, "low-carbon tourism" should be replaced with "rural low-carbon tourism" to enhance the item's contextual relevance. The questionnaire underwent review by five management and domain experts, with corresponding modifications made based on their feedback to ensure content validity. The questionnaire comprised 56 observed variables, of which 5 represented demographic information. The remaining 51 variables employed a five-point Likert scale, 1: Strongly disagree, 5: Strongly agree (**Appendix A**). The final sample size was determined to be 672, after excluding samples with missing values. The final valid questionnaire count stood at 620, representing a validity rate of 92%.

4. Results

4.1. Descriptive Statistics Analysis

Table 1 presents the basic demographic characteristics of the 620-strong sample. The distribution across gender, age, education, occupation and income is relatively balanced and diverse, ensuring broad representativeness of the sample's perspectives.

Table 1. Description of basic data about the population (n = 620).

Types	Category of Statistics	n	%
Gender	Male	282	45.5
	Female	338	54.5
Age	≤20 years old	30	4.8
	21–30 years old	190	30.6
	31–40 years old	203	32.7
	41–50 years old	125	20.2
	51–60 years old	45	7.3
	≥61 years old	27	4.4
Education level	Diploma or under	33	5.3
	Advance Diploma	158	25.5
	Bachelor's degree	267	43.1
	Master's degree	118	19.0
	Doctor's degree/PhD	44	7.1
Career	Student	51	8.2
	National public officials	101	16.3
	Company employees	190	30.6
	Individual workers	125	20.2
	Freelancer	81	13.1
	Retirement	38	6.1
	Other	34	5.5
Monthly income	≤10,000¥	130	21.0
	10,001–15,000¥	181	29.2
	15,001–20,000¥	172	27.7
	20,001–25,000¥	80	12.9
	≥25,001¥	57	9.2

4.2. Reliability Analysis and Validity Analysis

The reliability of the data was assessed using Cronbach's alpha coefficient. The overall reliability coefficient for the scale was 0.941. Each variable's Cronbach's alpha value exceeded 0.8, surpassing the threshold of 0.6 [37]. This indicates high internal consistency among items within each variable, confirming their validity in measuring the underlying constructs. The KMO value of 0.918 exceeded the threshold of 0.6, indicating an adequate sample size and sufficient sampling, rendering the data highly suitable for factor analysis (**Table 2**).

4.3. Common Method Bias

Whether the sample data exhibits homogeneity bias, in the Harman single-factor test, the unrotated first common factor explains 25.560% of the variance, falling below the standard threshold of 40%. This indicates that the common method variance in the sample data is insufficient to compromise the validity of the data [38].

4.4. Confirmatory Factor Analysis

All factor loadings for the items exceeded the 0.5 threshold, indicating that the items were highly significant for the factors and provided a robust explanation of them. The composite reliability (CR) value for each construct exceeded 0.8, surpassing the threshold of 0.7. The average variance extracted (AVE) values exceeded 0.5, surpassing the threshold of >0.5 [38], meeting the ideal criteria for convergent validity. This indicates that the constructs possess good internal consistency and that the measurement of the constructs is stable and effective (**Table 3**).

Table 2. Results of the reliability analysis of variables.

Variable	Items	Cronbach'α	Total Cronbach'α	KMO
Perceived Value of Low-carbon Tourism (PV)	9	0.884		
Social Norms (SN)	9	0.883		
Low-carbon Tourism Destination Context (LC)	14	0.912	0.941	0.918
Psychological Ownership (PO)	9	0.872		
Low-carbon Tourism Behavior (LTB)	10	0.882		

Table 3. Convergent Validity of Construct.

Construct	CR	AVE	Factor Loading Range
ECV	0.864	0.680	0.815–0.832
EMV	0.861	0.674	0.806–0.838
SOV	0.841	0.638	0.748–0.825
DEN	0.847	0.649	0.771–0.845
PRN	0.875	0.699	0.815–0.853
NOB	0.842	0.640	0.792–0.804
LEC	0.906	0.546	0.693–0.764
LEE	0.840	0.636	0.796–0.800
LEI	0.820	0.603	0.763–0.796
SOB	0.836	0.631	0.764–0.825
SOR	0.820	0.604	0.735-0.808
SEE	0.817	0.598	0.793–0.775
LPB	0.832	0.622	0.773–0.800
RTB	0.827	0.614	0.769–0.803
MTB	0.851	0.588	0.757–0.781

This study employed maximum likelihood estimation for the overall measurement model. The CFA fit indices met standard requirements; CMI/DF was 1.086, below 3 and thus compliant with criteria; RMSEA was 0.012, be-

low 0.08; RMR was 0.025, below 0.05. GFI is 0.981, NFI is 0.971, IFI is 0.998, and CFI is 0.998, all exceeding the standard value of 0.9; PNFI is 0.740, PGFI is 0.654, and PCFI is 0.760, all exceeding the standard of 0.5. Consequently, this measurement model demonstrates satisfactory fit, with the model specification deemed reasonably sound.

The Pearson correlation coefficient was selected as the statistical measure for assessing the correlation between variables [39]. The results (**Table 4**) indicate that all correlation coefficients between variables were statistically significant at the 0.001 level of statistical significance. The correlation coefficients between variables were below the threshold of 0.85 [39], indicating the absence of redundant structural factors.

Table 4. Inter-construct correlation table.

	PV	SN	LC	PO	LTB
PV	0.709				
SN	0.392***	0.708			
LC	0.523***	0.395***	0.709		
PO	0.531***	0.430***	0.608***	0.708	
LTB	0.599***	0.543***	0.634***	0.650***	0.708
Mean	3.479	3.372	3.403	3.288	3.391
Std. Deviation	0.881	0.854	0.823	0.838	0.814

Note: ***Correlation is significant at the 0.001 level ($p < 0.001$).

Discriminant validity was assessed using the Fornell-Larcker method, comparing the square root of the AVE for each construct with its correlation coefficients to the remaining constructs [40]. Values on the diagonal of the same latent variable correspond to the square root of its AVE. The results (**Table 4**) show that the square root of AVE exceeds the inter-construct correlation coefficients, indicating that the latent variables within the measurement model possess good discriminant validity.

4.5. Structural Model Analysis

All fit indices of the structural equation model meet the standard requirements (**Table 5**), indicating that the model exhibits a satisfactory level of fit.

Table 5. Fit index of SEM.

Index	x^2/df	RMSEA	RMR	GFI	NFI	IFI	CFI	PNFI	PGFI	PCFI
Reference value	<3	<0.08	<0.05	>0.9	>0.9	>0.9	>0.9	>0.5	>0.5	>0.5
Test value	1.086	0.012	0.025	0.981	0.971	0.998	0.998	0.740	0.654	0.760

The structural model was employed to test the hypothesized relationships (**Figure 2**). To reduce structural model complexity and enhance estimation stability, item parceling was applied at the first-order dimension level [41]. For each item within a first-order dimension, the mean was calculated to derive a composite dimension score. These composite scores were then introduced into the model as observed indicators for the second-order constructs (PV, SN, LC, PO, LTB). The results of the direct effect path analysis for the structural model (**Figure 2** and **Table 6**) revealed that the critical ratios (C.R.) All hypotheses exceeded 1.96 and were statistically significant ($p < 0.05$). Specifically, Perceived Value of Low-carbon Tourism (PV) exerts a positive influence on Low-carbon Tourism Behavior (LTB, $\beta = 0.228$, $p < 0.001$); Social Norms (SN) exerts a positive influence on Low-carbon Tourism Behavior (LTB, $\beta = 0.235$, $p < 0.001$); Low-carbon Tourism Destination Context (LC) exerts a positive influence on Low-carbon Tourism Behavior (LTB, $\beta = 0.256$, $p < 0.001$); Perceived Value of Low-carbon Tourism (PV) exerts a positive influence on Psychological Ownership (PO, $\beta = 0.250$, $p < 0.001$); Social Norms exerts a positive influence on Psychological Ownership (PO, $\beta = 0.170$, $p = 0.002$); Low-carbon Tourism Destination Context (LC) exerts a notable positive influence on Psychological Ownership (PO, $\beta = 0.410$, $p < 0.001$); Psychological Ownership (PO) exerts a positive influence on Low-carbon Tourism Behavior (LTB, $\beta = 0.228$, $p < 0.001$).

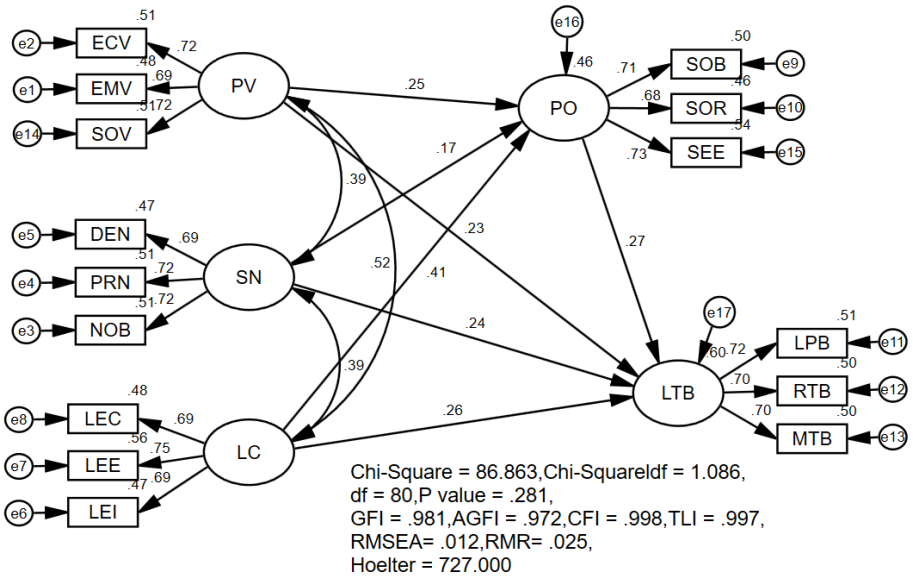

Figure 2. The Structural Equation Model.

Table 6. Investigate hypothetical path relationships.

Hypothesis	Path	Std. Estimate	Estimate	S.E.	C.R.	*p*	Results
H1.	PV→LTB	0.228	0.209	0.054	3.840	***	Accepted
H2.	SN→LTB	0.235	0.231	0.051	4.494	***	Accepted
H3.	LC→LTB	0.256	0.257	0.066	3.920	***	Accepted
H4.	PV→PO	0.250	0.246	0.061	4.021	***	Accepted
H5.	SN→PO	0.170	0.180	0.058	3.120	0.002	Accepted
H6.	LC→PO	0.410	0.444	0.071	6.261	***	Accepted
H7.	PO→LTB	0.273	0.253	0.062	4.059	***	Accepted

Note:***$p < 0.001$.

Mediation effects were tested using the Bootstrap method to assess their significance. Results (**Table 7**) indicate that the bias-corrected 95% confidence intervals (CI) all exclude zero, confirming the statistical significance and robustness of the mediating effects [42]. PO mediates the relationship between the three variables (PV, SN, LC) and LTB. Specifically: PV→PO→LTB (β = 0.068), accounting for 23.0% of PV's total effect on LTB; SN→PO→LTB (β = 0.046), accounting for 16.4% of SN's total effect on LTB; LC→PO→LTB (β = 0.112), accounting for 30.4% of LC's total effect on LTB.

Table 7. Mediation effect bootstrap test.

Hypothesis	Mediation Path	Std. Estimate	Bias-Corrected 95%CI		Results	Proportion of Total Effect
H8.	PV→PO→LTB	0.068	0.027	0.136	Accepted	23.0%
H9.	SN→PO→LTB	0.046	0.013	0.099	Accepted	16.4%
H10.	LC→PO→LTB	0.112	0.055	0.191	Accepted	30.4%
Total Effect 1	PV→LTB, PV→PO→LTB	0.296	0.145	0.428		
Total Effect 2	SN→LTB, SN→PO→LTB	0.281	0.164	0.409		
Total Effect 3	LC→LTB, LC→PO→LTB	0.368	0.241	0.507		

The model's explanatory power was assessed using the coefficient of determination (R^2) (**Table 8**). The three independent variables collectively explained 45.5% (R^2 = 0.455) of the variance in PO, demonstrating good explan-

atory power. The model accounted for 60.4% ($R^2 = 0.604$) of the variance in the dependent variable of low-carbon tourism behaviour. indicating the model possesses strong predictive capability.

Table 8. Model Summary.

Dependent Variable	SEM R^2
PO	0.455
LTB	0.604

5. Discussion

5.1. Key Findings

The SEM results confirmed all hypotheses: PV, SN, LC and PO all exerted positive effects on LTB, with PO acting as a mediator.

Firstly, PV, SN, LC and PO are all positively associated with LTB. This indicates that these variables exert a synergistic driving effect on low-carbon tourism behaviour, demonstrating that an integrated approach combining the perceived value of low-carbon tourism, social norms, the low-carbon context of the destination, and psychological ownership can enhance travellers' low-carbon tourism behaviour. This reflects the multidimensional nature of low-carbon tourism behaviour within rural tourism.

Secondly, PO serves as the mediating variable in the relationships between PV, SN, LC, and LTB. Among both direct and indirect influences, LC emerges as the most significant factor. This finding indicates that, compared to individual-level value perceptions and social group demonstration effects, destination-level physical contexts and external support exert a more direct and potent influence in promoting travellers' low-carbon tourism behaviour. This may be closely linked to the prevalent management model of ‘strong norms and strong protection’ in China's rural heritage tourism sites. Within these regulated rural heritage areas, constraints and guidance on tourist behaviour are typically reinforced through infrastructure provision, environmental protection measures, and mechanisms for educating and guiding tourist conduct. Consequently, in such contexts, low-carbon behaviour is more readily perceived as a ‘rule of the situation’ that ought to be followed and as a ‘situational response behaviour’. This finding further supports the ABC theory, indicating that when contextual factors are strong, their influence on behaviour may surpass that of individual internal factors. It also demonstrates that tourism destinations exert a significant influence on low-carbon behaviour through the shaping of low-carbon contexts.

Thirdly, the model demonstrates significant explanatory power for PO ($R^2 = 0.455$) and even greater explanatory power for LTB ($R^2 = 0.604$), indicating a robust level of explanatory capability. This suggests the model holds practical significance for guiding real-world activities.

5.2. Interpretation of Results and Theoretical Links

This study first examined the combined effects of perceived value of low-carbon tourism (PV), social norms (SN), low-carbon tourism destination context (LC) and psychological ownership (PO), revealing that low-carbon tourism behaviour arises from the synergistic effects of multidimensional factors. Existing research typically examines individual factors among these four, such as perceived value, destination support, or psychological ownership [12]. Others examine two factors, such as low-carbon tourism cognition and moral norms [34], or low-carbon tourism cognition and low-carbon tourism environment [21]. Some studies investigate three factors, primarily focusing on PV, SN, and LC. Psychological ownership, as a crucial variable influencing consumer attitudes and behaviour, has been empirically validated across diverse contexts. Existing research predominantly centres on organisational behaviour and product marketing domains, with limited application to tourist behaviour studies [28]. This study comprehensively examined these four factors, revealing that the direct effects exhibited near-moderate levels (path coefficients: 0.228–0.256). The model demonstrated strong explanatory power for LTB ($R^2 = 0.604$), indicating that the results stem from the cumulative and synergistic effects of multiple independent variables with weak to moderate influence. This aligns with the common characteristic in the humanities and social sciences that ‘multiple factors jointly influence the dependent variable, while a single factor rarely produces a strong driving effect’. The findings of this study align with existing research highlighting the positive influence of these factors on low-carbon tourism behaviour [34].

Secondly, the findings further confirm that psychological ownership (PO) serves as a mediating factor linking the perceived value of low-carbon tourism (PV), social norms (SN), and low-carbon tourism destination context (LC) to low-carbon tourism behaviour (LTB). While studies have established that PO influences low-carbon tourism behaviour, its mediating role has rarely been explored within the multi-factor framework of PV, SN, and LC pertaining to rural tourism low-carbon behaviour. The findings reveal that among these three factors, LC exerts the strongest mediating effect on low-carbon tourism behaviour through PO. The study found that the mediating effect of PV ($\beta = 0.068$) accounted for 23.0% of the total effect, the mediating effect of SN ($\beta = 0.046$) accounted for 16.4% of the total effect, and the mediating effect of LC ($\beta = 0.112$) accounted for 30.4% of the total effect. This indicates that the indirect effects are significant but contribute relatively less compared to the direct effects. The core influence in this study remains primarily driven by direct effects. Among these three factors, LC exerts the greatest mediating effect on low-carbon tourism behaviour through PO. This conclusion validates the CAB theory, which posits that an individual's cognition, affect, and behaviour constitute a hierarchical and progressive relationship.

Finally, the model explains 60.4% of the variance in LTB ($R^2 = 0.604$), indicating that it captures the primary variation in the dependent variable and possesses a strong level of explanatory power. Integrating these dimensions generates significant synergistic driving effects, rendering the model practically relevant for guiding real-world activities.

5.3. Practical Implications

The research findings provide practical guidance for multiple stakeholders in rural low-carbon tourism.

Government: Firstly, enhance policy support and public service systems for low-carbon tourism. Introduce specialised policies and development plans for rural low-carbon tourism, establish a low-carbon infrastructure network, and provide financial support to tourism industries offering low-carbon products and services. Secondly, strengthen publicity and education on the value of low-carbon tourism to foster a social environment conducive to low-carbon tourism practices.

Tourism Enterprises: Firstly, cultivate a low-carbon environment at tourist destinations, encompassing low-carbon transport, pedestrian greenways, low-carbon facilities, low-carbon itineraries, low-carbon experiential activities, cost-effective low-carbon products, low-carbon services, and economic incentives such as points or gift rewards. Secondly, enhance travellers' perception of low-carbon tourism value by disseminating low-carbon knowledge, visualising low-carbon benefits, and deepening travellers' understanding of ecological, emotional, and social values. Thirdly, foster a socially normative environment aligned with low-carbon principles by establishing prescriptive standards, promoting low-carbon tourism consumption concepts, and advocating low-carbon practices; Establish a "Rural Low-Carbon Tourism Charter" for scenic areas; create exemplary standards through initiatives like the "Rural Low-Carbon Action Star" awards. Finally, strengthen travellers' psychological ownership and sense of belonging by providing exclusive low-carbon commemorative tokens, such as personalised tree plaques. Enhance their sense of responsibility and efficacy by involving them in low-carbon development projects within rural attractions.

Tourists: Firstly, actively perceive the value of low-carbon rural tourism. Proactively learn about low-carbon environmental protection knowledge, enhancing awareness of its ecological, emotional and social value. Secondly, voluntarily adhere to low-carbon social norms. Comply with the Rural Low-Carbon Tourism Charter, actively participate in low-carbon initiatives, serve as role models, and share and promote such actions to set an example. Thirdly, integrate into the rural low-carbon environment. Support the low-carbon operational management of scenic areas by conserving water and electricity, reducing bed linen changes and room cleaning frequency, and bringing personal toiletries. Finally, actively cultivate psychological ownership of rural low-carbon tourism. Participate in voluntary carbon offset activities such as tree planting to foster a sense of belonging to the countryside, alongside a sense of responsibility and self-efficacy towards low-carbon actions.

In summary, travellers' low-carbon tourism behaviour in rural settings is not determined by a single factor, but rather by the synergistic influence of individual perceived value, the impact of social norms, the creation of low-carbon contexts, and psychological ownership. This

fully demonstrates the crucial role of integrating multidimensional factors in enhancing low-carbon tourism behaviour.

6. Limitations and Future Research

This study has certain limitations. Firstly, the findings are constrained by self-reported data, and their generalisability is subject to specific geographical and cultural contexts. Future research should endeavour to employ multi-source evaluation methods and incorporate comparative analyses across different types of tourist destinations and cultural backgrounds to address these limitations and enhance the universality and interpretability of the results.

Secondly, the low single-variable path coefficients provide direction for subsequent research. Further exploration of moderating effects between variables is warranted. For instance, introducing moderators such as time pressure could examine the boundary conditions that amplify the respective variable effects, thereby enabling a more nuanced analysis of the operational mechanisms among the study variables.

7. Conclusions

This study focuses on tourists in rural tourism as its research subjects, constructing and empirically validating a theoretical model promoting low-carbon tourism behavior. It specifically examines the role of low-carbon scenarios in rural tourism within the formation process of low-carbon behavior. Findings reveal that low-carbon tourism behavior is influenced not only by internal factors such as individual value perceptions, social norms, and psychological ownership, but more significantly by external contextual conditions. This indicates that within the environmentally constrained and resource-sensitive setting of rural tourism, visitor behavior is more readily guided by on-site facilities and regulatory frameworks. Enhancing low-carbon scenario design thus emerges as a critical pathway to elevate low-carbon tourism behavior. Integrating these factors to leverage synergistic effects can substantially boost low-carbon tourism practices. Theoretically, this study integrates dual perspectives from tourism and psychology to establish a comprehensive research framework, deepening low-carbon tourism research and expanding the applicability of theories like ABC theory within rural tourism and heritage conservation contexts. Practically, the findings provide direction for low-carbon governance in rural tourism destinations: governments and destination managers should prioritize establishing low-carbon contextual conditions while simultaneously enhancing tourists' value cognition, behavioral modeling, and psychological ownership of low-carbon actions to form a systemic support for low-carbon behavior. Future research may further examine the model's dynamic mechanisms and explanatory power by incorporating multiple case sites, cultural contexts, independent variables, and conditional variables.

Author Contributions

Conceptualization, L.Z. and C.S.; methodology, L.Z. and C.S.; investigation, L.Z.; data curation, L.Z.; writing—original draft preparation, L.Z.; writing—review and editing, C.S.; supervision, C.S. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

Appendix A

Table A1. Measurement Scales.

Measurement questions for Perceived Value of Low-Carbon Tourism	
PV1	Low-carbon tourism can reduce carbon emissions.
PV2	Low-carbon tourism contributes to mitigating global climate change.
PV3	Low-carbon emission reduction contributes to improving the living environment.
PV4	Low-carbon environmental protection is something to be appreciated.
PV5	Low-carbon environmental protection is something very meaningful.
PV6	Low-carbon environmental protection is something very valuable.
PV7	Participating in low-carbon rural tourism allows one to meet new friends.
PV8	Participating in low-carbon rural tourism can spark others' interest.
PV9	Participating in low-carbon rural tourism facilitates mutual exchange.
Measurement Questions for Social Norms	
SN1	Most families are involved in low-carbon tourism.
SN2	Most friends and colleagues are involved in low-carbon tourism.
SN3	More and more people in the community are involved in low-carbon tourism.
SN4	Most relatives believe that one should engage in low-carbon tourism.
SN5	Most friends and colleagues believe that one should engage in low-carbon tourism.
SN6	The idols and netizens who are concerned all believe that people should engage in low-carbon tourism.
SN7	Most families appreciate low-carbon tourism.
SN8	Most friends and colleagues appreciate low-carbon tourism.
SN9	There is often a publicity campaign in the community about low-carbon tourism.
Measurement Questions for Low-Carbon Tourism Destination Context	
LC1	It is convenient to take public transport.
LC2	The transportation within the scenic area uses new energy sightseeing vehicles and battery-powered vehicles.
LC3	There are low-energy consumption and low-carbon tourism routes and activities.
LC4	There are affordable green eco-friendly hotels.
LC5	Reduction in the supply of disposable items for catering and accommodation.
LC6	Offer local green foods and cultural products.
LC7	There are facilities for rubbish sorting and recycling.
LC8	Use energy-saving appliances and water-saving facilities.
LC9	Scenic areas have slogans, broadcasting Promote low-carbon tourism .
LC10	Scenic areas provide low-carbon tourism counselling.
LC11	Scenic areas have low-carbon signs and are equipped with low-carbon interpretation systems
LC12	The scenic area offers affordable public transport.
LC13	The scenic area offers cost-effective low-carbon tourism products.
LC14	The scenic area offers low-carbon tourism subsidies or incentives.

Table A1. *Cont.*

Measurement questions for Perceived Value of Low-Carbon Tourism	
Measurement Questions for Psychological Ownership	
PO1	Low-carbon rural tourism offers a relaxing experience.
PO2	Rural low-carbon tourism is a worthwhile endeavour.
PO3	Low-carbon rural tourism fosters a sense of pride.
PO4	to shoulder the responsibility of protecting the environment.
PO5	It is our responsibility to make efforts towards environmental protection in rural areas.
PO6	It is our duty to consciously protect the environment of the countryside.
PO7	Can do something to help the environment.
PO8	Behaviour can improve local environmental conditions.
PO9	Being able to protect the local environment while travelling in the countryside.
Measurement Questions for Low-Carbon Tourism Behavior	
LTB1	Do not purchase tourist goods with excessive packaging.
LTB2	Choose low-carbon materials and locally handmade cultural and creative products.
LTB3	Opt for locally sourced organic produce.
LTB4	Avoid using disposable products.
LTB5	Conservation of water, electricity and other resources.
LTB6	No requirement for hotels to change bed linen daily.
LTB7	Choose public transport and electric vehicles for travelling as much as possible.
LTB8	Choose public transport and electric vehicles for travelling as much as possible.
LTB9	Reduce travel waste, sort your rubbish.
LTB10	Participate in locally organised volunteer activities for carbon offsetting such as tree planting.

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