

Article

Constructing an Evaluation Index System for China's Low-Carbon Tourism Region—An Example from the Daxinganling Region

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Abstract: With the intensification of global warming, the development of low-carbon tourism is not only an inevitable requirement for human development, but also an important way to enhance tourism, improve the quality of tourism, and obtain greater economic and social benefits from tourism. Scientifically and effectively constructing a low-carbon tourism development level evaluation index system is conducive to the healthy and sustainable development of the tourism industry. However, the current evaluation of the development level of low-carbon tourism mainly focuses on low-carbon development, energy conservation, and emission reduction. There are few studies and a lack of specific empirical research evaluating the development of low-carbon tourism. In this research, the Delphi method and analytic hierarchy process were used for data collection and corresponding weight analysis. This research refers to the results of existing studies on low-carbon tourism evaluation index systems, and constructs an objective and quantitative evaluation model. It establishes a low-carbon tourism development evaluation model with 34 specific indicators from the three dimensions of the tourism economic support level, the tourism low-carbon development level, and the tourism policy support level. The research results were applied to the Daxinganling region for verification. The results show that the development of tourism in the Daxinganling region has changed from a mode dominated by economic interests to a mode in which tourism-related parties begin to seek effective low-carbon methods to maintain low-carbon tourism activities. In addition, the Daxinganling region has the lowest level of low-carbon tourism development and the highest level of financial support. Based on the research conclusions, corresponding suggestions for the development of low-carbon tourism in the Daxinganling region are provided. The results are also intended to provide a reference point in the optimization of low-carbon tourism development models in this and other regions.

Keywords: Daxinganling region; low-carbon tourism evaluation index system; Delphi–AHP method



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1. Introduction

With the growing problem of global warming, the concept of low-carbon tourism was officially introduced at the World Economic Forum in Copenhagen in 2009 [1]. As a trillion-dollar industry [2], global tourism accounts for about 7% of global exports and 8% of global carbon dioxide emissions [3,4]. Based on the current growth rate of the tourism industry, the contribution of tourism to global warming will increase by 188% by the year 2035 [5,6]. As a matter of course, reducing carbon emissions is a key responsibility of the tourism industry and a necessary requirement for the sustainable development of low-carbon tourism.

Low-carbon tourism is based on the concept of a low-carbon economy [7], with low energy consumption [8], low pollution and low emissions [9], which can better unify the economic, social and environmental benefits of tourism [10]. Current research on low-carbon tourism focuses on the measurement of carbon emissions in the tourism industry [11–13], the impact of tourism carbon emissions on the climate [14–16], and low-carbon tourism

strategies [17–19]. The research on low-carbon development in tourism regions focuses on low-carbon development paths [20–22] and macro-qualitative descriptions of low-carbon strategies [19,23,24]. Some of the results relate to the evaluation of low-carbon behavior in low-carbon regions [25–27], the evaluation of energy efficiency in low-carbon regions [28–30], and regional low-carbon decision making [31–33]. The literature on the low-carbon index of tourism regions is limited [34], and it lacks an evaluation index that truly satisfies the ideal characteristics of robustness, comparability, and reliability.

The aims of the authors in constructing a low-carbon tourism development level evaluation index system included not only revealing the current gaps in regional low-carbon tourism development, in order to promote cooperation of low-carbon tourism between regions, but also to help promote the sustainable development of tourism. In this paper, an objective and quantitative low-carbon tourism evaluation index model is constructed through an extensive literature review and expert interviews, utilizing the Delphi method and hierarchical analysis. This research is based on Daxinganling region as a representative example of the three major low-carbon tourism areas in China, and involved conducting a comprehensive evaluation and providing suggestions for its development. The developed model is intended for use in any region that is planning to develop its low-carbon tourism industry.

2. Research Methodology

2.1. Delphi–AHP Method

The Delphi–AHP method is a combination of Delphi survey and classic AHP method. In the Delphi–AHP method, the Delphi method is used to collect data from a pre-selected group of experts working in and researching tourism. In the subsequent stage, the Analytic Hierarchy Process is used to determine the weight of low-carbon tourism, which is used to create the development-level indicator system. This involves carrying out a multi-standard decision-making analysis on the relative weight of each influencing factor. The Delphi method is used as it allows comprehensive evaluation of predetermined factors and their relationships in a hierarchical model [35–37].

The Delphi–AHP method combines qualitative and quantitative research in order to raise the integrity of the research and provide higher-quality and more reliable analyses and conclusions [38–40]. Generally speaking, the Delphi method can help researchers deal with random data on expert opinions and enable better decision making. Similarly, the AHP process allows experts to focus on pairs of factors, rather than focusing on multiple factors at the same time.

This research aimed to use the Delphi–AHP method to construct a universal low-carbon tourism development evaluation index system.

2.2. Low-Carbon Evaluation Index System for Tourism Regions

In order to create a realistic and operable standard for use in the low-carbon development of tourism regions, this research establishes a scientific and feasible low-carbon tourism indicator system for use at the regional level. It was based on the following three main aspects. First, use of the experience of constructing low-carbon tourist attractions in the Daxinganling Scenic Area, a national low-carbon tourism demonstration area, as a reference to ensure the feasibility and practicality of the developed evaluation index system. Secondly, use of the National Low-Carbon Tourism Pilot Zone, the Low-Carbon Community Pilot Construction Guidelines, and the Low-Carbon Community Pilot Evaluation Index System of Scoring standards as a reference basis to ensure the scientific and authoritative integrity of the evaluation index system. Thirdly, use of the comprehensive evaluation index proposed by experts and researchers in the published literature as a reference basis to ensure the scientific integrity of the evaluation index.

Evaluation indicators (40) for use in tourism regions were formulated in accordance with the above three reference-based aspects, as shown in Table 1.

Table 1. Initial evaluation index of low-carbon tourism region.

No.	Index Content	No.	Index Content
1	Percentage of total tourism income to total local income	21	Harmless treatment of waste
2	Annual growth rate of total tourism revenue	22	Sewage treatment rate
3	Annual growth rate of total number of tourists	23	Utilization rate of low-carbon tourist facilities
4	Percentage of tourism employees to total number of local employees	24	Utilization rate of original ecological food in tourism
5	Number of tourist attractions	25	Utilization rate of biodegradable packaging bags for tourist souvenirs
6	Population density index (living-to-tour ratio)	26	Utilization rate of low-carbon tourism products
7	Average room occupancy rate	27	Utilization rate of disposable items in hotels and restaurants
8	Accessibility of tourist attractions	28	Participation of tourists in low-carbon tourism
9	Low-Carbon Tourism Festival	29	Participation of tourism practitioners in low-carbon tourism
10	Number of 5-star hotels	30	Participation of local residents in low-carbon tourism
11	Coverage rate of noise compliance area	31	Daily energy consumption per capita
12	Air-quality level	32	Percentage of Low-carbon investment to total tourism revenue
13	Water environmental quality	33	Reasonability of Tourist Satisfaction Evaluation
14	Utilization rate of low-carbon parking lots	34	Regular low-carbon environmental monitoring
15	Utilization rate of eco-friendly toilets	35	Establish a leading group for energy conservation and emission reduction management
16	Percentage of vehicles using clean energy	36	Tourist incentive rate for low-carbon behavior
17	Utilization rate of Renewable energy	37	Publicity and education of low-carbon tourism knowledge
18	Utilization rate of energy-saving equipment	38	Establish an energy saving and emission reduction management team
19	Utilization rate of low-carbon materials	39	Formulate rules for tourists' low-carbon behavior
20	Utilization rate of low-carbon technology	40	Formulate a special plan for low-carbon development

2.3. Selection of Low-Carbon Evaluation Indexes for Use in Low-Carbon Tourism Regions

2.3.1. Inclusion Criteria of the Expert Group

The Delphi method generally requires the experts selected to participate to be authoritative and representative professionals in related fields, as this influences the accuracy of the research results. The number of experts selected is preferably 15–50 [41,42]. Therefore, 15 experts were selected for this research, drawn from Chinese government officials, university teachers, and travel agency planners to participate in the Delphi method questionnaire survey. It should also be indicated that the questionnaire provided paper for the writing of responses. The inclusion criteria of members of the expert group were: (1) minimum of five years of experience in a professional tourism field; (2) general requirement of a master's degree or higher in the subject of tourism for participation in the correspondence inquiry about tourism; (3) willingness to actively cooperate in the completion of multiple rounds of expert letter inquiries in accordance with use of the Delphi method. Table 2 shows the background of the experts:

Table 2. Experts' backgrounds.

Background	Occupation or Department	Number of People Chosen	Job
Administration institution	Culture and Tourism Bureau of Daxinganling District Administration	4	Executive in related business
	Culture and Sports Broadcasting and Television Bureau and Tourism Bureau of Huzhong District, Daxinganling Region	3	Executive in related business
	Heilongjiang Provincial Bureau of Culture and Tourism	3	Executive in related business
	Heihe University	3	Certified lecturer
Private-sector business	China Travel International Travel Service	2	Travel planner

2.3.2. First Round of Questionnaire Surveys

A questionnaire was created based on the 40 indicators, a copy of which each of the 15 experts received. The experts were asked to evaluate the 40 indicators for their relevance to the topic. The questionnaire also contained open-ended questions. Experts gave feedback on irrelevant or incorrect indicators and wrote suggestions for including other more relevant indicators. Among the 15 questionnaires returned, the index selection rate was 67%. Among them, 27 indexes were selected 10 times, and 13 indexes were selected by less than two-thirds of the respondents. Accordingly, it was concluded that these 13 indexes were not relevant to the topic under discussion, and they were therefore omitted.

2.3.3. Second Round of Questionnaire Surveys

After the first round of questionnaire surveys, indexes with selection rates below 67% were deleted. Further, based on the experts' feedback, indicators were deleted, modified, or integrated to create a new questionnaire, which was then distributed to the experts. The experts evaluated the importance and feasibility level of each indicator using a 5-point composite Likert scale. Each indicator was assigned a score from 1 to 5, ranging from "very unimportant" to "very important" or from "very infeasible" to "very feasible".

A new low-carbon evaluation index system for tourism regions was established based on the results of the two rounds of questionnaires. The index system allows the systematic evaluation of the financial support level, low-carbon tourism development level, and policy support level (A3). Eight tertiary indicators and 34 quaternary indicators are decomposed under the three secondary indicators, as shown in Table 3.

2.4. Calculation of Weights of Low-Carbon Evaluation Indicators in Tourist Regions

(1) Construction of the judgment matrix:

This research invited 15 tourism experts to take part in a questionnaire survey and used the pairwise comparison method to determine the Saaty scale [43]. The judgment matrix of each level was constructed according to the Saaty scalar processing principle.

(2) Establishing the weight and consistency test of each layer:

Using the constructed judgment matrix, the Yaahp 10.1 meta-decision software was used to calculate the initial weights and combined weights of the factors at each level, as shown in Table 3. At the same time, the consistency test was carried out, and the consistency test results of the single-level ranking and the total-index ranking calculated by Yaahp 10.1 were all less than 0.1. This indicated that the results of this paper were consistent.

Table 3. Evaluation indicators and weights of low-carbon tourism region.

First Level	Second Level (Weight)	Third Level (Weight)	Fourth Level	Weight
Construction of evaluation index system for low-carbon tourism in tourist region	Financial support level (A1) 0.120	Tourism economic level (B1) 0.333	Percentage of total tourism income to total local income (C1)	0.667
			Annual growth rate of total tourism revenue (C2)	0.333
		Tourism level (B2) 0.667	Annual growth rate of total number of tourists (C3)	0.417
			Percentage of tourism employees to total number of local employees (C4)	0.121
			Number of tourist attractions (C5)	0.193
			Number of 5-star hotels (C6)	0.270
	Low-carbon environment (B3) 0.107	Coverage rate of noise compliance region (C7)	0.197	
		Air-quality level (C8)	0.491	
		Water environmental quality (C9)	0.312	
	Low-carbon tourism development level (A2) 0.608	Low-carbon facilities (B4) 0.445	Utilization rate of low-carbon parking lots (C10)	0.038
			Utilization rate of eco-friendly toilets (C11)	0.059
			Percentage of vehicles using clean energy (C12)	0.146
		Low-carbon products (B5) 0.283	Utilization rate of energy-saving equipment (C13)	0.092
			Utilization rate of Renewable energy (C14)	0.073
			Utilization rate of low-carbon materials (C15)	0.057
			Utilization rate of low-carbon technology (C16)	0.235
			Harmless treatment of waste (C17)	0.191
			Sewage treatment rate (C18)	0.109
			Utilization rate of low-carbon tourist facilities (C19)	0.121
	Low-carbon behavior (B6) 0.165	Utilization rate of original ecological food in tourism (C20)	0.234	
		Utilization rate of biodegradable packaging bags for tourist souvenirs (C21)	0.170	
		Utilization rate of low-carbon tourism products (C22)	0.109	
	Policy support level (A3) 0.272	Supervision and governance level (B7) 0.333	Utilization rate of disposable items in hotels and restaurants (C23)	0.366
			Participation of tourism practitioners in low-carbon tourism (C24)	0.400
			Participation of tourist in low-carbon tourism (C25)	0.200
		System construction level (B8) 0.667	Participation of local residents in low-carbon tourism (C26)	0.400
			Percentage of low-carbon investment to total tourism revenue (C27)	0.343
			Regular low-carbon environmental monitoring (C28)	0.191
	System construction level (B8) 0.667	Supervision and governance level (B7) 0.333	Establish a leading group for energy conservation and emission reduction management (C29)	0.161
			Tourist incentive rate for low-carbon behavior (C30)	0.106
		System construction level (B8) 0.667	Publicity and education of low-carbon tourism knowledge (C31)	0.199
			Establish an energy saving and emission reduction management team (C32)	0.198
	System construction level (B8) 0.667	System construction level (B8) 0.667	Formulate rules for tourists' low-carbon behavior (C33)	0.312
			Formulate a special plan for low-carbon development (C34)	0.491

2.5. Selection of the Evaluation Method

In order to better reflect the overall low-carbon tourism development level of the region from different aspects for each individual index, this research adopted the multi-

objective linear weighting function method to establish an evaluation model to determine the level of low-carbon development in the Daxinganling region, as shown below:

$$I_w = \sum_{wq=1}^i \left[\sum_{wp=1}^j \left(\sum_{wo=1}^k X_{wwo} \right) \times X_{wpp} \right] \times X_{wqq} \quad (1)$$

where: I_w is the comprehensive evaluation value; X_{wwo} is the product of a single index and the weight at this level; X_{wpp} is the weight of the wp -th single element at this level; X_{wqq} is the weight of the wq -th individual criterion at this level; k is the number of indicators ($P = 34$ in this indicator system); j is the number of elements ($n = 8$ in this indicator system); i is the number of criteria ($I = 3$ in this indicator system).

2.6. Quantification Standard and Value of Evaluation Index

This research organized 10 experts and researchers in the low-carbon tourism industry to rate the indicators of this study at all levels. It is noteworthy that the expert group's evaluation was based on existing Chinese or international standards and each indicator was judged and scored according to the actual situation in the Daxinganling region, as detailed in Table 4. The scores of the 10 experts for each indicator were then averaged and used as the final evaluation score for each indicator. Subsequently, the multi-objective linear weighting function method was used to calculate the final evaluation value, based on which the level of low-carbon development was judged.

Table 4. Comprehensive rating of low-carbon tourism development in Daxinganling region.

Index	Current Status According to the Index	Score	Weight	Total Score (Xwo)
C1	Total tourism revenue accounted for 50% of total local revenues.	74.7	0.667	49.8
C2	20% annual growth rate of total tourism revenue.	76.0	0.333	25.3
C3	10% annual growth rate of total number of tourists received.	82.3	0.417	34.3
C4	10% of workforce employed in tourism sector.	68.0	0.121	8.2
C5	Nearly 50 tourist attractions.	85.0	0.193	16.4
C6	20% hotel occupancy rate of 4 stars and above.	70.0	0.270	18.9
C7	Coverage rate of 95% noise up to standard level.	87.0	0.197	17.1
C8	Number of days with good air quality is more than 300 days.	98.0	0.491	48.1
C9	Quality of the water environment meets international standards.	96.0	0.312	30.0
C10	With high greening effect and high-permeability performance, the parking lot utilization rate exceeds 80%.	50.0	0.038	1.9
C11	Utilization rate of eco-friendly and wash-free toilets exceeds 70%.	51.0	0.059	3.0
C12	100% clean energy vehicle utilization rate.	55.0	0.146	8.0
C13	100% energy-saving equipment utilization rate.	61.0	0.092	5.6
C14	100% utilization rate of solar and wind energy.	72.0	0.073	5.3
C15	100% utilization rate of low-carbon building materials.	65.0	0.057	3.7
C16	100% usage rate of electronic bills.	84.0	0.235	19.7
C17	100% harmless treatment rate of domestic garbage.	62.0	0.191	11.8
C18	100% sewage treatment rate.	59.0	0.109	6.4
C19	100% utilization rate of low-carbon tourist facilities.	54.0	0.121	6.5
C20	100% usage rate of original ecological food in tourism.	78.0	0.234	18.3
C21	60% utilization rate of low-carbon packaging for tourist souvenirs.	60.0	0.170	10.2
C22	100% low-carbon tourism product development rate.	65.0	0.109	7.1
C23	100% of hotels and restaurants use disposable utensils.	89.0	0.366	32.6
C24	100% of tourism practitioners participate in low-carbon tourism.	54.0	0.400	21.6
C25	100% of tourists participate in low-carbon tourism.	83.0	0.200	16.6
C26	100% of local residents participate in low-carbon tourism.	71.0	0.400	28.4
C27	Low-carbon investment accounts for 80% of total tourism revenue.	79.0	0.343	27.1
C28	Regular environmental monitoring is carried out.	77.0	0.191	14.7
C29	Management system is in place.	66.0	0.161	10.6
C30	Management system is in place.	26.0	0.106	2.8
C31	Absence of publicity and education.	70.0	0.199	13.9
C32	Absence of leading management group.	66.0	0.198	13.1
C33	Absence of behavior rules.	66.0	0.312	20.6
C34	Special plan exists.	80.0	0.491	39.3

The final composite score was divided into four levels according to the degree of decarbonization of each indicator. The values, from small to large, are (0–50), (50–70), (70–85), and (85–100), which correspond to the exploration period (low-carbon preparation stage), the starting period (low-carbon foundation stage), the development period (low-carbon development stage), and the mature period (mature low-carbon stage), respectively, as shown in Table 5.

Table 5. Classification standards for low-carbon tourism region [44].

Stage	Value Range	Evaluation
Exploration period	(0–50)	Participants in the tourism industry have poor low-carbon awareness
Starting period	(50–70)	Deterioration of the natural ecological environment has attracted the attention of the tourism industry
Development period	(70–85)	Tourism industry began to establish a relatively stable low-carbon development channel
Mature period	(85–100)	Tourism industry has initially realized the harmonious development of man, nature, and economy

3. Empirical Research on Daxinganling Region

3.1. Overview of the Current Situation of Tourism in the Daxinganling Region

The Daxinganling region is located in the northwestern part of Heilongjiang Province, the northernmost border region of China (Figure 1). This unique geographical location leads to a monopoly and scarcity of tourism resources and landscapes. Daxinganling not only contains the densest high-quality cold-temperate forestry ecological landscape in China, but also very wide-ranging topography and landforms as well as biodiversity. According to data released by the Daxinganling District Office of Heilongjiang Province Government and the government website of the State Forestry and Grassland Administration of China, as of 2020, there were more than 50 natural tourism resources in the Daxinganling region.



Figure 1. Location of Daxinganling region in China: (a) overall location of Daxinganling in China (Wikipedia); (b) detailed location of Daxinganling (image source from China map).

As well as natural tourism resources, Daxinganling has a rich historical and cultural heritage. It is one of the ancient birthplaces of the Chinese nation, and provides a vivid reflection of the country's development, such as Shibazhan, an ancient city island, the Yaksa

ancient battlefield and the Qing dynasty Yanzhigou gold mine, (Figure 2). Information can be obtained from the website of the Chinese State Forestry and Grassland Administration. In summary, the tourism resources found in Daxinganling have a high historical and ornamental value.

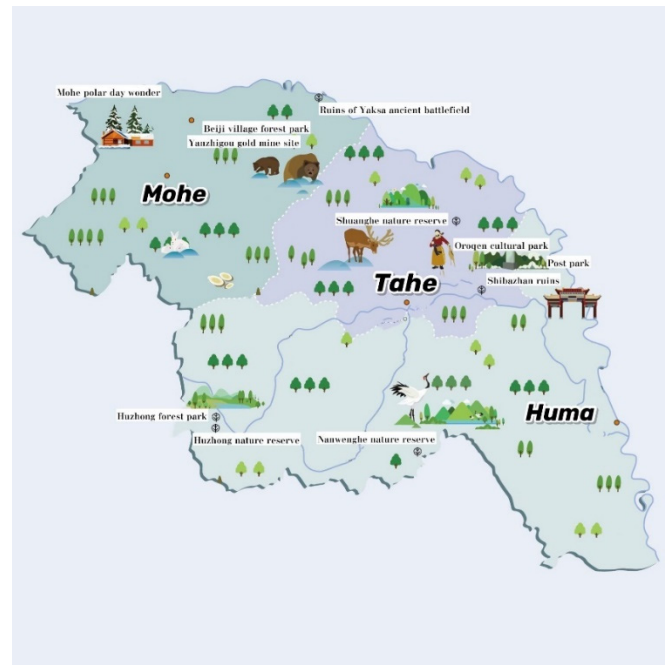


Figure 2. Map of scenic spots in Daxinganling region (part of Inner Mongolia Province; image source: Author's depiction).

3.2. Evaluation of Low-Carbon Tourism Development in the Daxinganling Region

As explained above, the evaluation scores in Table 3 were obtained through arithmetic means from the experts' scores of indicators of low-carbon tourism development in Daxinganling. To provide more details on the status of low-carbon tourism development in Daxinganling region, this study further calculated comprehensive scores for Daxinganling region via the multi-objective linear weighting function method. This method produced scores related to development level of low-carbon tourism in the Daxinganling region, as shown in Table 6.

Table 6. Scores for low-carbon tourism development levels in Daxinganling region.

First-Level	Score	Second-Level	Score	Third-Level	Score
Construction of evaluation index system for low-carbon tourism in tourist region	72.2	Financial support level (A1)	76.9	Tourism economic level (B1)	75.1
				Tourism level (B2)	77.8
		Low-carbon tourism development level (A2)	71.4	Low-carbon environment (B3)	95.2
				Low-carbon facilities (B4)	65.4
				Low-carbon products (B5)	74.7
				Low-carbon behavior (B6)	66.6
		Policy support level (A3)	71.7	Supervision and governance level (B7)	69.1
				System construction level (B8)	73.0

As can be seen from Table 6, the overall score for low-carbon tourism development in Daxinganling region is 72.2, which illustrates that the industry is still itself undergoing development. It reflects the following aspects: The development of tourism in Daxinganling region has changed from its original mode, dominated by economic interests, to a mode in which tourism-related parties have begun to actively seek various effective ways to

maintain low-carbon tourism activities. While the tourism industry's new path aims for relatively stable low-carbon development, some room remains for its improvement to a more mature form of low-carbon tourism. In addition, from the second-level scores, it can be seen that the Daxinganling region has the lowest level of low-carbon tourism development and the highest level of financial support. This indicates that Daxinganling region has increased its financial support for tourism. However, the development of low-carbon tourism has not yet achieved the expected results. There is, therefore, an urgent need to improve relevant policies related to low-carbon tourism. Furthermore, from the perspective of the third-level scoring, Daxinganling has the highest score for low-carbon environment. This shows that the region itself has excellent conditions. However, low-carbon facilities, low-carbon behavior, and low-carbon supervision and governance are relatively poor, which shows that the aspects of low-carbon operations and low-carbon literacy need to be improved.

4. Suggestions on Optimizing Tourism Development in Daxinganling Region

4.1. Promote Energy-Saving Technologies and the Recycling of Tourism Resources in Tourism

The utilization rate of low-carbon materials and energy-saving equipment in many facilities in the Daxinganling region is extremely low. In addition, the actual hotels and tourist facilities were built many years ago, and the energy-saving equipment and related technologies have not been updated over time. Therefore, greater attention should be paid to sewage treatment, the use of energy-saving equipment, and the use of renewable building materials to construct tourist facilities. This is not only conducive to the recycling of resources but can also fundamentally help realize low-carbon tourism.

4.2. Promote Low-Carbon Tourism Behaviour by Advocating Low-Carbon Tourism Lifestyles and Tourism Consumption

The willingness of tourists determines whether low-carbon measures are being effectively implemented. Therefore, the government or enterprises in the Daxinganling region need to promote low-carbon tourism behavior and strengthen low-carbon publicity so as to guide people toward consuming low-carbon tourism, such as through the promotion of awareness of low-carbon tourism and environmental protection through the media, deepening public understanding of the importance of low-carbon tourism, and guiding tourists to adopt a low-carbon tourism mindset and consumption patterns.

4.3. Strengthen the Supervision and System Construction of Low-Carbon Tourism Development

Tourism enterprises and individuals need to be encouraged to develop low-carbon tourism through formulating incentives or preferential tax policies. At the same time, relevant rules, regulations and administrative procedures need to be introduced to urge the tourism industry towards energy conservation and emission reduction in order to promote the development of the low-carbon economy. For example, low-carbon tourism products could be promoted in the tourism process with the provision of a free low-carbon quota per person, which, if exceeded, incurs a fee. This would regulate tourism products and help implement the low-carbon concept. In addition, a low-carbon code of conduct for tourists should be enacted to regulate tourist behaviors in terms of specific contractual rules.

4.4. Enhancing Innovation in Low-Carbon Tourism Products and Services

The process of creating low-carbon tourism is one of innovation. The Daxinganling region needs to enrich low-carbon tourism products and services to enhance the low-carbon experience of tourists, such as in catering, shopping, transportation and through other means. In catering, priority should be given to choosing original ecological foods and adjusting serving sizes to avoid food waste; in shopping, tourism products should be designed in accordance with the low-carbon theme such as through the use of pollution-free packaging and local materials; and in transportation, the region should strive to provide unique tourism experiences, such as hiking, horse riding and ziplining.

5. Conclusions

This research makes use of the experience of low-carbon tourism in the Daxinganling Scenic Area, a national low-carbon tourism demonstration area, and adopts the scoring criteria of the National Low-Carbon Tourism Pilot Area, the Low-Carbon Community Pilot Construction Guide, and the Low-Carbon Community Pilot Evaluation Index System as a reference basis. The research clearly shows the issues requiring attention when developing low-carbon tourism regions, and the model it presents can be used to evaluate the development level of low-carbon tourism in regions. This provides an effective means to discover existing issues, which can be solved accordingly. The current study also provides a comprehensive reference and standard for the level of development of low-carbon tourism for use by the government and tourism sectors, and, compared with the conventional index system reviewed above, provides a richer source for the index and a more operationally useful system when constructing an evaluation index system for low-carbon tourist regions. The system provided comprises three dimensions: the economic support level, the low-carbon tourism development level, and the policy support level. It also provides 34 specific indicators.

The research results show that in the evaluation of low-carbon tourism in tourist regions, the actual level of low-carbon tourism development is the most important factor. Therefore, it is particularly important to improve the quality of tourism environment, build low-carbon tourism facilities, use low-carbon tourism products, and guide low-carbon tourism behavior, such as in promoting the use of energy-saving technologies, recycling resources, energy-saving equipment, and environmentally friendly building materials. The next key aspect is policy support level, with special emphasis on incentives for promoting low-carbon tourism behavior, formulating guidelines for low-carbon tourist behavior, and formulating special plans for low-carbon development.

Based on the empirical research covering the Daxinganling region, the operability of the evaluation index system has been verified. Therefore, tourism regions intending to develop low-carbon tourism may make use this index system to optimize the process of low-carbon tourism development. More importantly, the research results of this article are intended to assist the government, enterprises, and tourists to cooperate to achieve sustainable tourism development. In terms of limitations, this research made use of the Delphi and AHP methods, which led to a certain degree of subjectivity in the selection of indicators, and this may have affected the results. Standardizing the raw data of indicators also proved a challenge, which may have influenced the results. Further, low-carbon tourism as a field covers multiple subjects. We therefore suggest that any future research be carried out making use of more diverse and representative evaluation indicators in order for the system to provide higher utility to prospective users in the field of sustainable tourism development.

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