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Research on the evaluation model of rural colony tourism resources based on AHP

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Abstract: *At present, the conventional rural colony tourism resources evaluation is mainly through the extraction of the basic features of the whole region tourism, to achieve the effective mining of tourism resources indicators to assess the elements, due to the lack of refinement of the analysis of the grading criteria, resulting in poor evaluation of the model. In this regard, the rural settlement tourism resources evaluation model based on AHP is proposed. Firstly, the evaluation index system is constructed by combining the evaluation principles of rural tourism resources and referring to the common evaluation factors of tourism resources. Then the judgment matrix is constructed by combining the proportional scale of relative importance of elements. Finally, the evaluation levels of tourism resources under the perspective of regional tourism are set by weighting, and the scoring levels are refined. In the experiment, the evaluation effect of the proposed method was verified. Finally, the experimental comparison results can prove that when the proposed method is used to evaluate the tourism resources of rural settlements, the scoring error value of the algorithm is low, and it has a more ideal evaluation effect.*

Keywords: *AHP; rural tourism resources; evaluation methods; judgment matrix*

1. Introduction

The evaluation of rural tourism resources differs from the evaluation of tourism resources or agricultural resources in terms of determining evaluation indexes, scoring standards, and other aspects. However, due to their inherent specificity and the close connection between rural tourism resources, tourism resources, and agricultural resources, a comparative study reveals that there are certain similarities among the evaluation of rural tourism resources, tourism resources, and agricultural resources in certain aspects. Therefore, this systematic evaluation method can be applied to the evaluation of ecotourism resources and some agricultural resources, as well as the evaluation of some general tourism resources. As for the concept of rural tourism resources, different scholars have elaborated this concept from different perspectives[1]. It can be viewed from both geographical and content aspects. Analyzed from the geographical aspect, rural tourism resources refer to all tangible and intangible rural tourism resources contained within a certain range. Generally speaking, the natural geographical landscapes, water resources, ecological landscapes and some unique historical relics of villages belong to rural tourism resources. Therefore, all the resources that can be used for tourism within the geographical scope of the village are the tourism resources of the village, which is the explanation for the rural tourism resources[2]. After entering the new era, the country's development of tourism resources has risen to an unprecedented height, adhering to the concept of rationalization and sustainable development of rural tourism resources. Under this premise, it is defined as all the resources that can be used to develop rural tourism products in the rural area without destroying the local ecological environment. Therefore, it can be considered that rural tourism resources are the sum of resources with economic and ecological benefits that can be attractive to rural tourists. To sum up, it can be considered that rural tourism resources are all the tangible and intangible resources that can be used for tourism and can be used for tourism within a certain territorial scope on the basis of ecological protection and other development principles[3]. Evaluation of tourism resources refers to determining the status of a certain tourism resource among all tourism resources or similar tourism resources according to certain criteria, that is, comparing tourism resources both vertically and horizontally, in order to determine the importance and development value of a certain tourism resource[4]. Specifically, tourism resource evaluation is to make scientific value judgment on the quantity and scale of tourism resources, quality level, regional environment, development conditions, utilization prospect and other

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factors and to define tourism development potential of a region on the basis of tourism resource investigation. The core task is to provide a basis for the tourism development of the region to determine the orientation, theme image and development scale. Through the study of rural tourism resources assessment at home and abroad, it is not difficult to find that there is a lack of general research in the case study of rural tourism resources assessment. Compared with the foreign research on it, China's research in this area is still in its infancy. On the whole, China focuses on a single indicator when evaluating rural tourism resources, and there is not yet a unified standard and system for evaluating tourism resources in rural areas. With the implementation of rural revitalization strategy, the industrialization of rural tourism will be an inevitable in the future development. In view of this, this paper will make a comprehensive assessment of the factors affecting the development of each indicator of rural tourism resources, and finally analyze the evaluation results and classify the grades, and according to the analysis of the resource evaluation results, and combined with the local tourism resources development policy and development principles, give the development ideas of rural tourism in the region and the corresponding development countermeasures[5].

2. Rural tourism resources evaluation index system construction

Rural tourism resources are characterized by seasonality and vulnerability, and when evaluating them, they should be combined with their own characteristics, and diversified evaluation methods should be adopted, including field visits, interviews, questionnaires, data analysis and so on, in order to ensure the comprehensiveness, relevance and scientificity of the evaluation conclusions. Therefore, the following principles should be followed in the evaluation[6].

(1) The principle of typicality

When evaluating rural tourism resources, it is important not to generalize, for example, by taking into account factors such as history, culture and ecological environment, as well as factors such as tourists' satisfaction, management level and service quality. Therefore, when selecting evaluation indicators, it is necessary to comprehensively consider a variety of factors to ensure that the indicators can correctly reflect the type of rural tourism resources, resource value and resource development potential[7].

(2) Principle of comprehensiveness

There are various types of rural tourism resources, with a significant geographical diversity. Therefore, when evaluating rural tourism resources, it is important to first consider the cultural and environmental aspects of the region comprehensively. Additionally, a comprehensive evaluation should also be conducted on the quality, value, and potential of these resources, in order to effectively explore and utilize the rural tourism resources [8].

(3) Principle of practicality

In selecting indicators, full consideration should be given to the actual local situation, starting from the objective reality of rural areas, linking with the actual local development situation, selecting valuable indicators according to the characteristics of the evaluation indicator factors, combining with relevant theoretical contents, and expanding their practical value more effectively, so as to obtain useful information.

(4) Combining qualitative and quantitative principles

At present, in the assessment of tourism resources, scholars usually adopt the combination of qualitative and quantitative methods, which is an organic combination of qualitative and quantitative methods, while the qualitative analysis is relatively single, mainly relying on the evaluator's knowledge and experience to carry out a kind of subjective judgment, which is highly subjective. The quantitative analysis is a systematic and scientific research on the index factors of tourism resources by analyzing a large amount of data and constructing a set of scientific mathematical model, and the conclusions obtained are objective and precise. Due to the diverse nature of rural tourism, it is important to avoid subjective opinions and adhere to objective criteria when conducting evaluations. Utilizing two methods of analysis, one can objectively analyze the results [9].

When evaluating rural tourism resources, the rationality of the evaluation indexes has a great influence on the correctness of the evaluation results. Therefore, when evaluating rural tourism resources, it is necessary to make a scientific and reasonable selection of its indicators, and try to choose factors that can reflect the actual situation and are representative. On this basis, based on the

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above evaluation principles of rural tourism resources, combining AHP and fuzzy comprehensive evaluation theory, referring to the common evaluation factors of tourism resources in China, and consulting the opinions of experts and tourism-related practitioners, we select 11 evaluation indexes to construct a scientific and reasonable comprehensive evaluation system of rural tourism resources, as shown in Table 1.

Table 1: Rural tourism resources evaluation index system

Target Layer	Guideline Layer	Indicator Layer
Rural Tourism Resource Types	Rural Tourism Resource Types	Types of rural resources
		Rural Resource Abundance
		Degree of geographical combination
		Scale of rural resources
	Development Conditions	Industrial base conditions
		Economic and social conditions
		Location conditions
		Transportation conditions
	Quality of Rural Tourism Resources	Rarity and peculiarity
		Ornamental Value
		Visibility and Influence
		Historical and Cultural Value

3. AHP-based judgment matrix construction

When using the AHP method to solve practical problems, the first step requires that it must be clear exactly what problems are needed for us to study and analyze, and then hierarchize and organize the research problems to form a stepped hierarchy. The laddered hierarchy of hierarchical analysis is generally divided into three levels, namely[10].

(1) Objective level (top level): indicates the issues that require specific research and analysis.

(2) Criteria layer (intermediate layer): indicates the criteria affecting the realization of the objective layer.

(3) Factor level (lowest level): indicates specific solutions to problems requiring specific research.

The target level, i.e., the top level, is first identified through a comprehensive analysis of the research problem and on the basis of the opinions of experts and scholars. At the top level, there is one and only one evaluation indicator, which is the specific issue to be studied[11].

The second step is to analyze which guidelines will have an impact on the target layer and list them as the lower layer. In general, there are multiple factors that influence the indicators of the overall target layer. It is necessary to conduct a detailed analysis of the interrelationships between these indicators and determine which ones are primary indicators and which ones serve as sub-indicators for the primary ones. Based on these interrelationships, the indicator factors should be divided into several groups and hierarchical layers. Generally, sub-indicators falling under the same primary indicators are governed by them, while indicators that do not belong to the same group possess distinct characteristics and are associated with different higher-level indicators [12].

Special cases also occur, usually in ladder hierarchies with complex relationships, usually when the relationship between different groups is not clear, and sometimes when there are intersecting hierarchies, but whatever the relationship between them, the lower level belongs to the upper level and is obvious.

The third (final) step builds on the guideline level (intermediate level) by analyzing the problem that requires decision-making and proposing specific measures for eventual solution of the problem, placing them at the lowest level of the stepped hierarchy as the factor level.

On the basis of determining the elements of each level of the laddered hierarchy, the factors that have affiliation between them are connected by lines, and the laddered hierarchy to be studied is formed. In this paper, based on the laddered hierarchy established earlier, n judgment matrices can be constructed and the quantitative calculation of the assignment can be carried out.

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The specific method of constructing the judgment matrix of the evaluation indicator system is: each indicator with a downward hierarchical in-depth development relationship is the first indicator of this judgment matrix, and the other indicators it contains are arranged one at a time downward and to the right.

When determining the weights of the indicators at each level, if only qualitative analysis of the indicators at each level is carried out and quantitative analysis is missing to participate, the program cannot be well determined. Therefore, some experts suggest using relative proportions to minimize the comparison of factors with different attributes in order to secondly improve the accuracy. The judgment of the value of each element in the matrix indicates the expert's opinion of the relative importance of each element, which is generally characterized using a scale from 1 to 9. When each factor is compared with each other, the actual significance is indicated by a familiar reflection of the judgmental value of the corresponding element of the matrix. A matrix consisting of the results of two-by-two comparisons is known as a judgment matrix. This is shown in Table 2.

Table 2: Scale of relative importance of elements

Quantitative figures	Qualitative meaning
1	Equal influence of the former and the latter
3	The former is slightly more influential when comparing the former and the latter.
5	The former is more influential when comparing the former and the latter.
7	Comparing the two before and after, the former is significantly more influential.
9	The former is very influential when comparing the two before and after.
2/4/6/8	The influence of the former is between the above quantitative figures in the before and after comparison.
1/2,1/4,...,1/8	Comparing the two before and after, the former's influence is opposite to the above quantitative figures.

In this regard, the judgment matrix expression constructed in this paper is shown below.

$$A=\begin{Bmatrix} a_{11} & a_{12} & ... & a_{1j} \\ a_{21} & a_{22} & ... & a_{2j} \\ ... & ... & ... & ... \\ a_{i1} & a_{i2} & ... & a_{ij} \end{Bmatrix} \tag{1}$$

Through the two-by-two comparison of the influencing factors between the SWOT groups, the judgment matrix of advantages, disadvantages, opportunities and threats is derived, and then the AHP hierarchical analysis in the SPSSAU software is used to calculate the weights of the single-level indexes between the groups and between the groups of SWOT, and the weight values are obtained subsequently. The specific calculation steps are as follows.

First, the geometric mean of each row of the judgment matrix is calculated using the product square root method, as shown below[13].

$$\overline{W_i}=\left(\prod_{j=1}^{n} a_{ij}\right) i, j=1,2,...,n \tag{2}$$

Where a_{ij} represents the elements in the judgment matrix. Then the geometric mean of the pairs of rows is normalized and the resulting eigenvector expression is shown below.

$$W_i=\frac{\overline{w_i}}{\sum_{j=0}^{n}\overline{w_j}} i, j=1,2,...,n \tag{3}$$

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Where W_i represents the eigenvectors, and $\overline{w_i}$ and $\overline{w_j}$ represent the geometric mean values corresponding to the elements at different positions in the judgment matrix, respectively.

4. Tourism resources evaluation grading standard construction

The fuzzy composite scoring method is suitable for situations where assessment indicators cannot be measured by fixed values. It is a scoring method that uses a given interval of fuzzy values for scoring and scores within that interval. On this basis, this paper combines China's actual situation and puts forward a tourism resource assessment model that is suitable for China's national conditions, representative, highly adaptable and sustainable. Drawing on the research results about tourism resource assessment at home and abroad, this paper proposes the index assessment guidelines for tourism resource assessment and consults experts and scholars in related fields. Using the fuzzy comprehensive scoring method, from the perspective of regional tourism, the hundred system scoring method is applied to grade each indicator level of the tourism resource assessment index system, and the scoring standard of each indicator is determined from high to low. Utilizing the above methodology, the indicator criteria were divided into I, II, III, IV, V from the highest to the lowest level and the following table was developed: Using the interval scoring method, the full score is 100 points and each level has a specific scoring range[14]. The evaluation criteria for tourism resource indicators are shown in Table 3.

Table 3: Scoring criteria for tourism resource indicators

Evaluation factor	Indicator assessment criteria				
Types of rural resources	I100-80	II80-60	III 60-40	IV 40-20	V 20-0
Rural Resource Abundance	≥90%	70-90%	50-70%	30-50%	≤30%
Degree of geographical combination	≥10	7-9	5-7	3-5	≤3
Scale of rural resources	≥10	7-9	5-7	3-5	≤3
Industrial base conditions	extremely high	relatively high	Average	Low	Very low
Economic and social conditions	extremely high	relatively high	Average	Low	Very low
Location conditions	≥10	7-9	5-7	3-5	≤3

In this study, the calculation method of the assessment results of tourism resources under the perspective of regional tourism is as follows: according to the scoring guidelines in the table, score each index, get the scoring results of each index and its corresponding weighting coefficients; take each domain level as a unit, and take each domain level as a unit, and sum up the weights of the assessment indexes below the level with the weights of the principal component analysis to get the weights on the level; and then, according to the dimension level, sum up the weight scores of the weight scores of each element level below the hierarchy are totaled to obtain the weight scores of the standard hierarchy[15].

After that, the resulting comprehensive results are divided into two categories: scoring and grading. In the existing research, for in the context of the whole region tourism, there has not been developed a standard value of assessment, so the author uses the weight of percentage to define a standard value of assessment. The specific method is as follows. If the weighted total score of all domain grades of each tourism resource in the study area reaches the fully qualified standard, i.e., 60%, it indicates that the assessed tourism resource has the basic conditions for tourism resource development and has the potential to be developed into a high-quality tourism resource. According to the criteria for dividing tourism resources in the national standard assessment system, this study divides tourism resources into five grades based on the comprehensive assessment score S of tourism resources, as shown in Table 4.

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Table 4: Classification criteria of tourism resources

Tourism Resource Grade	Score range	Description
Grade V Tourism Resources	S≥90	Special Grade Tourism Resources
Grade IV Tourism Resources	80-90	Excellent Tourism Resources
Grade III Tourism Resources	60-80	Good Grade Tourism Resources
Grade II Tourism Resources	40-60	Ordinary Grade Tourism Resources
Grade I Tourism Resources	S≤40	Inferior Grade Tourism Resources

Through the above steps, we can complete the construction of tourism resources grading standards. By reviewing relevant norms and literature, designing the percentage scoring standards for each sub-indicator of the index layer, and determining the assessment methods and assessment result standards for tourism resources under the perspective of regional tourism, a comprehensive and systematic tourism resources assessment system under the perspective of regional tourism is finally constructed, which is used to carry out the assessment of the development and current status of tourism resources.

5. Experimental component

5.1 Experimental preparation

In order to assess the effect of the improved algorithm proposed in this paper, this experiment selected two conventional rural settlement tourism resource evaluation methods as the comparison object, and simulated evaluation and analysis of the experimental dataset using the three resource evaluation methods respectively to compare the actual effect of different methods.

The experimental research scope of this paper is a famous tourist area in a city, which includes 17 towns and involves many tourist attractions according to the official website of the regional government. Taking the whole area of the study area as the research sample, based on the evaluation criteria and relevant data calculation, the value of the main tourism resources of each town in the study area is evaluated, and according to the evaluation results, the corresponding planning and development strategies for the development and utilization of tourism resources within the study area are proposed, which provide certain reference significance for further promoting the development of the whole area of tourism in the study area. Through the comprehensive investigation of tourism resources in the study area, it is found that it has 487 tourism resources. All tourism resources can be categorized into 8 main categories, 17 subcategories and 42 subdivided categories. The number of main categories of tourism resources in the study area accounts for 100% of the total number of tourism resources in the country, the number of subcategories accounts for 70% of the total number of tourism resources in the country, and the number of basic types accounts for 40% of the total number of tourism resources in the country, which indicates that the region has a very rich variety of tourism resources. In terms of resource attributes, there are 157 natural types and 330 humanistic types in this study area, accounting for 32.24% and 67.76% of the total, respectively. In terms of the total amount of tourism resources, cultural tourism resources in the region are twice as much as natural tourism resources, and the total amount of cultural resources far exceeds that of natural resources.

5.2 Experimental results

The comparative indicator chosen in this experiment is the evaluation accuracy of different evaluation methods. The specific measurement indicator is the error value of the evaluation score of the tourism resources in the research area. The lower the value, the better the evaluation effect of the representative method. The comparison results of evaluation score errors are shown in Figure 1.

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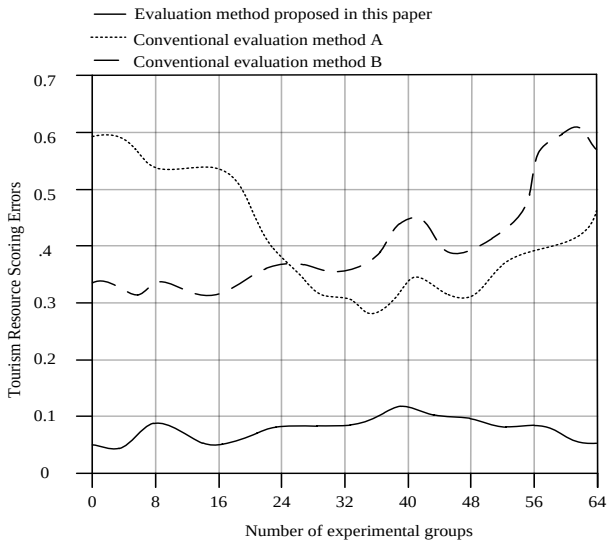

Figure 1: Results of evaluation score error comparison

Through the above experimental results, it can be seen that when evaluating tourism resources for the same group of experimental objects, the evaluation effects of different evaluation methods are different. Through numerical comparison, it can be seen that the rural settlement tourism resources evaluation model based on AHP proposed in this paper has higher evaluation accuracy, and the error value of evaluation scores is significantly lower than that of the two conventional evaluation methods.

6. Conclusion

This study aims to establish a tourism resource assessment system applicable to whole-area tourism, and conducts a comprehensive assessment and puts forward reference opinions on the tourism resources of a certain region. In the process, the relevant situations in the assessment of tourism resources at home and abroad are summarized, and the concept as well as the characteristics of whole-area tourism are systematically sorted out. By understanding the connotation of the value of tourism resources in the new period, a tourism resource index assessment system applicable to the whole region tourism is established.

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