Application of AHP in the Evaluation of Tourism Resources in Ethnic Regions: Case Study of Xichang, Liangshan Yi Autonomous Prefecture, China

Zuozhenmo Ma¹, Yi Cai², Jinyu Pan³

¹ Sichuan University, Chengdu, 615000, P.R. China
² GuiZhou University of Finance and Economics, Guiyang, 550000, China

Abstract—Tourism resource evaluation is a comprehensive, multi-factor and multi-criteria complex problem, is the basis of tourism development. It is reasonable to regional tourism resources development and utilization plays an important role, and by using AHP method to construct consists of resource conditions, environmental value and facilities management, and other three factor criterion layer and rule layer of 15 children factor of Xichang tourism resources evaluation model.

1. Introduction
Tourism resources refer to the natural existence and historical heritage that are attractive to tourists, as well as the artificial creations directly used in tourism[1]. The development of tourism largely depends on the development and utilization of tourism resources, especially how to better develop and utilize tourism resources in ethnic areas? First need to evaluate the tourism resources, that is, using the scientific method to select some factor judging the value of tourism resources and identification, to analyze the value of its development, determine the appeal after the tourism resource development and scale, to provide scientific basis for tourism development planning, and lay a foundation for the reasonable use and protection of tourism resources.

2. Methodology and Data Analysis

2.1 Conceptual Foundation
AHP(Analytic Hierarchy Process) is a multi-objective decision analysis method combining qualitative analysis and quantitative calculation put forward by professor T.L. Saaty, an operations research scientist at the university of Pittsburgh in 1970s[2]. It is an effective method of quantitative analysis of non-quantitative events. The basic idea of AHP is to establish an internal hierarchical structure describing system functions or characteristics according to the requirements of the problem. Then, by comparing the relative importance of the factors, the corresponding scale is given, and the judgment matrix of the upper factors to the lower factors is constructed, so as to determine the relative importance sequence of the upper factors. On the premise of meeting the consistency principle, single ranking of factors under the target is carried out, and then the ranking of factors under each sub-target is summarized layer by layer, and the overall ranking of factors under the overall target is given. The practice of tourism development shows that AHP is a mature and traditional method for tourism resource evaluation[3].
2.2 Establish Hierarchical Structure Model
Whether the tourism resources evaluation is accurate and scientific, the selection of evaluation factors is very critical\cite{4}. Based on the comprehensive consideration of factors, such as the quantity and nature distribution of tourism resources in Xichang, the evaluation model is divided into three levels: Target level -- taking" the overall evaluation of tourism resources in Xichang " as the overall evaluation objective, is recorded as layer A; Criterion layer -- selecting resource conditions, environmental value and facilities management as evaluation criteria, is recorded as layer B; Sub-criteria layer -- selecting indicators that can highlight the study of regional tourism resources as evaluation factors, is recorded as layer C. Layer C is the sub-layer of B, in which resource conditions include ornamentality, singularity, leisure, scientific research and so on. Environmental value includes environmental cleanliness, climate environment, environmental capacity, greening degree of scenic spots and ecological carrying capacity etc. Facility management includes accommodation, transportation and communication, medical and health, management level and personnel quality, etc. (Figure 1).

2.3 Constructing Judgment Matrix
After building the hierarchical structure model, the factors in the same layer are compared with the influence or importance of the upper layer, assuming that the element $A_k$ of the upper layer is the criterion, and for the elements $B_1, B_2$ of the next layer. According to the evaluation scale (Table 1), the importance of $B_i$ and $B_j$ for $A_k$ is expressed quantitatively, that is, the relative importance of $C_i$ over $C_j$ for $A_k$.

2.4 Computing Weight Vector
Normalize the column vectors of matrix $A$, and get the standard matrix $B = (b_{ij})_{n \times n}$, and $b_{ij} = \frac{a_{ij}}{\sum_{i} a_{ij}}$. Then sum and normalize by row, the column vectors obtained are:

$$\omega = (\omega_1, \omega_2, \omega_3, ..., \omega_n)^T$$

that is the eigenvector of the matrix, where

$$\omega_i = \frac{1}{n} \sum_{j=1}^{n} b_{ij} \quad (i, j=1,2,\ldots,n).$$

Fig.1 Model of Evaluation of Tourism in Xichang
### Tab. 1 The relative importance scales of AHP

| Scale | Meaning |
|-------|---------|
| 1     | The two factors are equally important. |
| 3     | Comparing two factors, one is slightly more important than the other. |
| 5     | Comparing two factors, one is obviously more important than the other. |
| 7     | Comparing two factors, one is highly more important than the other. |
| 9     | Comparing two factors, one is extremely more important than the other. |
| 2, 4, 6, 8 | The median of the above two adjacent judgements |

### 2.5 Weight and Consistency Testing at Different Levels

The maximum eigenvalues and standardized eigenvectors of each judgment matrix are obtained respectively. The eigenvector is the weight of the importance level of each factor at the same level. The maximum eigenvalues and corresponding eigenvector in formula $\lambda_{\text{max}} w = \frac{1}{n} \sum_{i=1}^{n} (A \omega_i)$, consistency index $CI = \frac{\lambda_{\text{max}} - n}{n - 1}$, consistency check $CR = CI / RT$.

### 2.6 Entropy Technology to Correct Weight

Step 1: The constructed judgment matrix $A = \{a_{ij}\}_{n \times n}$, normalize the column vectors of matrix A, get the standard matrix: $B = \{b_{ij}\}_{n \times n}$, and calculate the output entropy of the $j$ index $f_i$: $E_j = -K \sum_{i=1}^{n} b_{ij} \ln b_{ij} \quad (j=1,2,\ldots,n)$, where the constant $K = \left(\ln n\right)^{-1}$; verifiable: $0 \leq E_j \leq 1$.

Step 2: Find the deviation Degree $d_j$ of Index $x_j$: $d_j = 1 - E_j \quad (j=1,2,3,\ldots,n)$.

Step 3: Calculating the information weight of index $x_j$: $\mu_j = \frac{d_j}{\sum_{j=1}^{n} d_j} \quad (j=1,2,3,\ldots,n)$.

Step 4: The information weight $\mu_j$ is used to modify the weight vector $\omega$, and the results are as follows: $\lambda_j = \frac{\mu_j \omega_j}{\sum_{j=1}^{n} \mu_j \omega_j} \quad (j=1,2,3,\ldots,n)$.

### 3. Analysis of evaluation results

#### 3.1 B and C Layer Index Weight Calculation

The scale of each factor in Xichang's tourism resources evaluation has been obtained by more than 20 experts in tourism, environmental protection, forestry and urban construction using Delphi method. According to the above method, the weights of each evaluation index (Table 2) and the ranks of each factor are obtained by computer processing.

### Tab. 2 The values of indicator weight coefficient through correcting for level A to level C based on entropy technologies

| Index hierarchy | Index code | $E_j$ | $d_j$ | $\mu_j$ | $\lambda_j$ | Revised weights $\omega_j$ |
|-----------------|-----------|------|------|--------|-----------|------------------|

3
| A-B | B | 0.8194 | 0.1806 | 0.4435 | 0.4312 | 0.3380 |
|-----|----|--------|--------|--------|--------|--------|
| B1  |    |        |        |        |        |        |
| B2  | 0.8528 | 0.1472 | 0.3616 | 0.4286 | 0.4120 |
| B3  | 0.9206 | 0.0794 | 0.1950 | 0.1402 | 0.2500 |
| B-C1| C1  | 0.9284 | 0.0716 | 0.1164 | 0.0931 | 0.1632 |
| C2  | 0.8492 | 0.1508 | 0.2452 | 0.2681 | 0.2232 |
| C3  | 0.8445 | 0.1555 | 0.2527 | 0.2488 | 0.2099 |
| C4  | 0.8114 | 0.1186 | 0.1929 | 0.2015 | 0.2132 |
| C5  | 0.8114 | 0.1186 | 0.1929 | 0.1886 | 0.1995 |
| B-C2| C6  | 0.7851 | 0.2149 | 0.2665 | 0.2367 | 0.1526 |
| C7  | 0.8847 | 0.1153 | 0.1429 | 0.2444 | 0.2939 |
| C8  | 0.8075 | 0.1925 | 0.2387 | 0.1489 | 0.1072 |
| C9  | 0.9312 | 0.0688 | 0.0853 | 0.0968 | 0.1950 |
| C10 | 0.7850 | 0.2150 | 0.2666 | 0.2732 | 0.1762 |
| B-C3| C11 | 0.9015 | 0.0985 | 0.1936 | 0.2367 | 0.2515 |
| C12 | 0.8824 | 0.1176 | 0.2311 | 0.2444 | 0.1363 |
| C13 | 0.9229 | 0.0771 | 0.1514 | 0.1923 | 0.2470 |
| C14 | 0.8944 | 0.1056 | 0.2076 | 0.2524 | 0.2366 |
| C15 | 0.8899 | 0.1101 | 0.2163 | 0.1430 | 0.1286 |

**3.2 Comprehensive evaluation analysis**

From the ranking result of criterion level factor B (Table 3), the weight value of environmental value is 0.4120, which is greater than that of resource value and facility management in three aspects: resource condition, environmental value and facility management. It shows that the environmental value determines the potential of resource development and the key factors of attracting tourists under the circumstances of rapid economic development, rapid increase of tourist population, more and more severe Urban Haze Weather and increasing urban population. It shows that the environmental value determines the potential of resource development and the key factors of attracting tourists under the circumstances of rapid economic development, rapid increase of tourist population, more and more severe Urban Haze Weather and increasing urban population. The ideal tourist destination should be a vacation and leisure place with high environmental value, such as good air quality, excellent scenic environment and high greening rate. Therefore, the most important factor should be the environmental value. Accordingly, Xichang can rely on a good natural environment to create tourism products and leisure resorts.

| Tab.3 Weighting and ranking number in layer B and layer C |
|---------------------------------------------------------|
| Constrained layer B | Weight value | Rank | Constraint Layer C | Weight value | Rank |
|----------------------|---------------|------|---------------------|---------------|------|
| Resource conditions  | B1            | 0.4380 | 2                   | Ornamental C1 | 0.1632 | 11   |
|                      |               |      | Singularity C2      | 0.2232        | 2    |
|                      |               |      | Leisure C3          | 0.2009        | 7    |
|                      |               |      | Scientific research C4| 0.2132      | 6    |
|                      |               |      | Cultural value C5   | 0.1995        | 8    |
| Environmental value  | B2            | 0.4120 | 1                   | Clmatic environment C6 | 0.1526 | 12   |
|                      |               |      | Environmental capacity C7 | 0.2939    | 1    |
|                      |               |      | Environmental cleanliness C8 | 0.1072     | 15   |
|                      |               |      | Ecological carrying capacity C9 | 0.1950    | 9    |
|                      |               |      | Landscape greening C10 | 0.1762       | 10   |
| Facility management  | B3            | 0.2500 | 3                   | Transport and Communications C11 | 0.2515 | 2    |
|                      |               |      | Accommodation conditions C12 | 0.1363     | 13   |
|                      |               |      | Management Level C13 | 0.2470       | 3    |
|                      |               |      | Health care C14     | 0.2366        | 4    |
|                      |               |      | Health care C15     | 0.1286        | 14   |
4. Conclusion

From the results of quantitative evaluation of tourism resources in Xichang. Firstly, we should give full play to the advantages of environmental value and resources, plan scientifically and take various measures. Secondly, scientific planning is particularly important. It should stress the principles of adapting measures to local conditions, rational layout and highlighting characteristics. Thirdly, community residents should be encouraged to participate in tourism planning, management, scientific research and protection. Improve the civilized level of the community and realize the sustainable development of Xichang. Finally, we should persist in the principle of “protection first”. Tourism development should be controlled within the scope of bearing capacity of ecological environment, and environmental education should be strengthened for tourists.

Acknowledgment

Subsidized projects: The National Social Science Fund of China: “The influence of Yi traditional culture on the community governance in Sichuan Yi Autonomous Region and the Countermeasures” (CM15CMCO33)

References

[1] LIU YONG, HAN TAI FAN et al. Evaluation of Mianshan tourism resources and sustainable development countermeasures based on AHP method [J]. Economic geography: 2006, 26 (2): 346-348.

[2] ORAMS M B. Towards a more sustainable form of tourism [J]. Tourism Management, 1995, 16: 3 -8.

[3] SCHEYVENS R. Ecotourism and the empowerment of local communities [J]. Tourism Management, 1999, 20: 245 -249.

[4] HULL J S. Ecotourism Handbook: protected areas and local communities—case studies from the Middle East and North America [M]. QLF/Atlantic Center for the Environment, Ipswich, Massachusetts and Montreal, Quebec, 2000. 15 -21.

[5] WALLACE G N, PIERCE S M. An evaluation of ecotourism in Amazonas, Brazil [J]. Annals of Tourism Research, 1996, 23(4): 843 -873.

[6] LINDBERG K, et al. Ecotourism in the Asia-Pacific region: issues and outlook [M]. Ecotourism Society United States Department of Agriculture; Forestry Policy and Planning Division, Rome regional office for Asia and the Pacific, Bangkok, 1998. 53 -54.

[7] ROSS S, WALL G. Ecotourism congruence between theory and practice [J]. Tourism Management, 1999, 20(1): 123 -132.