

Design and Application of a TOPSIS-Based Fuzzy Algorithm

A Case Study from Tourism Attraction Evaluation

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Abstract—The study aims to evaluate the tourism attractiveness of different tourist attractions in the same region through the TOPSIS model in the perspective of culture and tourism integration, so as to provide theoretical and practical support for the tourism development of the region. On the basis of the concept of culture and tourism integration and its importance in tourism development, the evaluation index system of tourism attraction is constructed, including the indicators of tourism resources, tourism infrastructure, etc. Finally, the entropy weighting method and TOPSIS model are used for the comprehensive evaluation of these indicators, and the weight of each indicator and the comprehensive score of the tourism attraction of a certain place are derived through calculation. The results show that through the analysis of the TOPSIS model, the advantages and shortcomings of the region in terms of tourism resources and cultural characteristics can be clearly understood, and recommendations can be targeted, including strengthening tourism infrastructure construction, excavating and protecting cultural characteristics, and so on. These suggestions can help to further improve and enhance the tourism attractiveness of a certain place, so as to attract more tourists and promote the development of the local economy. Meanwhile, the methodology and framework of this study also provide reference and reference for other regions to carry out similar tourism attractiveness evaluation. In the context of cultural and tourism integration, this study expands the perspective of tourism evaluation and provides new ideas and methods for local tourism development.

Keywords—Cultural and tourism integration; attractiveness; TOPSIS; entropy weight method

I. INTRODUCTION

The integration of culture and tourism refers to the deep integration of culture and tourism, through the excavation and use of local cultural resources, to create a destination with cultural charm and tourism attraction [1]. In order to achieve a win-win situation of cultural heritage and tourism in today's society, the integration of culture and tourism has become a hot topic in the development of the tourism industry, for the evaluation of tourism attraction under the integration of culture and tourism, academics and the tourism industry have carried out a lot of research [2, 3].

In the study of tourism attractiveness evaluation under the perspective of culture and tourism integration, scholars are committed to constructing the evaluation index system, determining the weights of the indexes and selecting the comprehensive evaluation method, so as to comprehensively consider the impact of culture and tourism integration on tourism attractiveness [4, 5]. First of all, in terms of the

evaluation index system, the index system usually includes indicators of tourism resources, infrastructure, service quality, cultural characteristics and other aspects, in order to comprehensively evaluate the tourism attractiveness of the destination [6, 7]. For example, the indicators of tourism resources can include natural landscape, historical sites, folk customs, etc.; the indicators of infrastructure can include the degree of accessibility, accommodation facilities, catering services, etc.; the indicators of service quality can include the attitude of tourism services, the quality of tour guides, and tourism safety [8]. Meanwhile, in order to accurately evaluate tourism attractiveness [9], it is necessary to determine the weight of each indicator, and under the perspective of cultural and tourism integration, the importance of different indicators may change, so it is necessary to determine the weight by appropriate methods [10]. Researchers usually adopt methods such as hierarchical analysis (AHP) [11] or principal component analysis (PCA) [12,13] in order to determine the weights of the indicators so as to reflect the importance of each indicator more accurately in the comprehensive evaluation. Meanwhile, evaluation method is an important part of the evaluation model, and different scholars have tried different methods to evaluate the attractiveness, such as fuzzy theory-based tourism attractiveness evaluation [14,15], MBO method [16], the integrated method of MDS and ANP method [17], and many other evaluation methods [18, 19].

Under the perspective of culture and tourism integration, the evaluation of tourism attractiveness not only needs to build a good indicator system, but also for the selection of the evaluation model is also crucial, while the increase in the number of tourists in recent years shows that how to choose good tourist attractions for travellers has become a point of concern, and the use of fuzzy comprehensive evaluation and other methods of selection of multiple attractions is a little bit of heavy workload, and computationally redundant [20]. The TOPSIS model, as a commonly used multi-indicator comprehensive evaluation method, has been widely used in various fields of evaluation, the model can be used in the evaluation and selection of tourist destinations through the comprehensive calculation of the scores and weights of the indicators to arrive at a comprehensive evaluation of tourism attractiveness of the destination [21, 23]. Therefore, this paper builds the evaluation index system on the accumulation of literature, and at the same time adopts the entropy weight method and the improved TOPSIS method to construct the evaluation model, which is used to study the evaluation of tourist attractiveness of tourist attractions under the perspective of

culture and tourism fusion, with a view to providing an in-depth exploration and expansion of the concept of culture and tourism fusion, promoting the continuous improvement and innovation of the theory of culture and tourism fusion, and at the same time, providing the scientific evaluation method and decision-making reference for the development of local tourism.

II. EVALUATION MODEL CONSTRUCTION

A. Cultural and Tourism Integration

Culture and tourism integration refers to the in-depth integration of the two industries of culture and tourism to achieve the goal of mutual promotion and common development. In the integration of culture and tourism, several key points can be summarised as follows through relevant research:

- Cultural inheritance and innovation: The integration of culture and tourism requires that traditional culture be inherited and protected, while also focusing on innovation and giving traditional culture modern connotations to make it more in line with the aesthetics and needs of contemporary people.
- Integration and development of tourism resources: Fully integrate local tourism resources such as natural scenery and humanistic landscapes, carry out planning and development, and create distinctive and quality tourism products and services.
- Integration of cultural and tourism projects: Through cultural and artistic performances, cultural and creative bazaars, and cultural themed exhibitions, culture and tourism projects are combined to enrich the experience and feelings of tourists.
- Cultural and tourism industry linkage: Encouraging the in-depth integration of the cultural industry with the tourism industry, promoting the interactive development of cultural and creative products and tourism products, and forming an industry linkage effect.
- Culture and tourism branding: With the help of cultural resources and tourist attractions, create a culture and tourism brand with local characteristics and cultural connotations, and enhance the image and popularity of the place.
- Cultural and tourism marketing and promotion: Use new media and social platforms to promote cultural and tourism products and attract more tourists and cultural enthusiasts.
- Public services for culture and tourism: Upgrading cultural and tourism service facilities and public services to provide visitors and residents with a better cultural experience and tourism environment.

Many studies consider the above seven key points to be

effectively integrated and implemented, and the integration of culture and tourism will be able to realise the complementary advantages of culture and tourism and promote the sustainable development of local economy and society. The author's research believes that the evaluation of attractiveness of tourist attractions is closely related to the integration of culture and tourism, and that cultural heritage and tourism experience directly affect the attractiveness of tourist attractions; excellent cultural heritage and rich tourism experience can enhance the attractiveness of attractions and attract more tourists to come to visit them, while creative design and sustainable development can add new charms to attractions and make them stand out in the highly competitive tourism market. Therefore, the key points of cultural and tourism integration are closely linked to the relationship between the attractiveness evaluation of tourist attractions, which promotes the enhancement of the cultural value and attractiveness of tourist destinations and injects new vitality into the development of the tourism industry. Therefore, this paper will carry out the tourism attractiveness evaluation based on cultural and tourism integration through different tourist attractions, to explore the important influencing factors of cultural and tourism integration and their degree of influence on the attractions.

B. Constructing the Evaluation Index System

Existing studies believe that the construction of tourism attraction evaluation index system under the perspective of culture and tourism integration should contain multiple dimensions, such as natural environment, cultural heritage, tourism infrastructure, service quality, etc., in order to comprehensively assess tourism attraction. At the same time, the evaluation indicators should be comparable to facilitate comparison between different regions or attractions, and the meaning of the indicators should also take into account the regional characteristics and differences; in view of the fact that the current indicators are more subjective, the evaluation indicators should be quantifiable, so that it is easy to collect and analyse the data, based on which to ensure the objectivity of the evaluation results.

Through reviewing the literature, this paper argues that the indicator system needs to take into account the cultural, natural environment and historical characteristics of different regions, i.e., the evaluation indicators should have a certain degree of geographical adaptability, avoiding the simple application of standard indicators. Given that most of the research objects become attractions have been solidified, the index referentiality needs to be sufficient, and should be based on the status quo more easily accessible data and information, to avoid difficult to obtain or inaccurate data. At the same time, taking into account that the tourism market serves the market, so the evaluation index system should adapt to the changes in the tourism market and environment. Finally, this paper considers that the evaluation indexes should be operable, so that managers and decision-makers can take corresponding management measures according to the evaluation results. Based on this, this paper finally constructs the indicator system as shown in Table I.

TABLE I. TOURISM ATTRACTION EVALUATION INDEX SYSTEM BASED ON THE CONCEPT OF CULTURAL AND TOURISM INTEGRATION

Level 1 indicators	Secondary indicators	Indicator assessment content
Indicators of cultural content	Number of cultural heritages	Measures the amount of important cultural heritage, such as historical buildings, monuments and artefacts that a destination possesses.
	Status of protection of cultural heritage	Assessment of the protection and restoration of cultural heritage at the destination, including restoration work, regulatory measures, etc.
	Richness of cultural activities	Measure the number and quality of cultural festivals, exhibitions, performances and other events organized by the destination.
	Development of cultural industries	Assess the scale and contribution of the destination's cultural industries, including cultural and creative products, cultural and artistic performances, and so on.
Tourism infrastructure indicators	Accessibility	Evaluate how well the destination is connected to the transport network, including accessibility by road, rail and air.
	Accommodation facilities	Measures the number and quality level of accommodation facilities such as hotels, B&Bs and resorts in the destination.
	Tourism reception capacity	Evaluate the destination's capacity and level of service to tourists, including guides, interpreters, reception facilities, etc.
	Service level of guided tours	Measure the professionalism and service attitude of the destination guide.
Natural landscape indicators	Quality of the natural environment	Measurement of natural environmental indicators such as air quality, water quality and environmental cleanliness of the destination.
	Natural landscape features	Evaluate the unique natural landscape features of the destination, such as mountains, lakes and forests.
	Ecotourism resources	Measures the richness of the destination's ecotourism resources, including wildlife, eco-farms, etc.
Indicators for cultural and tourism integration projects	Development of Cultural and Creative Industries	Assess the extent and impact of the cultural and creative industries in the destination.
	Culture and Tourism Integration Construction	To measure the construction of demonstration projects and demonstration areas in the field of cultural and tourism integration in destinations.
	Cultural and Tourism Integration Activities Organised	To assess the number and quality of cultural and tourism integration activities organised by the destination, such as cultural and arts festivals and cultural and creative bazaars.
Indicators of tourist satisfaction	Traveller's comment	Gather travellers' ratings and opinions about the destination, including attractions, services, transport and more.
	Tourist return rate	To assess the proportion of tourists who choose the destination again to travel, reflecting the return and loyalty of the destination's visitors.
	Word-of-mouth communication	Evaluate the destination's word-of-mouth and user experience through online and social media channels.

It can be seen that in the evaluation of the attractiveness of tourism regions, the indicator system based on the integration of culture and tourism is considered more comprehensively, and as we all know, the concept of integration of culture and tourism refers to the integration of culture and tourism to create attractions or projects with cultural connotations and tourism attractiveness. Therefore, it can be seen that the following characteristics are presented when constructing tourism attraction indicators:

1) *Cultural connotation*: Whether the attraction or project has rich cultural connotation, such as historical heritage, folk customs, artistic performance, etc., which can be reflected by indicators of cultural heritage, history and culture, folk customs, etc., and is compatible with the first-level indicator of cultural connotation indicators.

2) *Tourism facilities*: Whether the attraction or project provides perfect tourism facilities and services, such as convenient transport, accommodation and catering, and guided tour services. This can be reflected through the indicators of convenient transportation, accommodation and catering support, which corresponds to the tourism infrastructure indicator in this paper.

3) *Experience and interaction*: Whether the attraction or project provides rich experience and interactive projects, such as cultural experience, handicraft production, interactive performances, etc., which can be reflected through the

indicators of experiential projects and interactive activities, which corresponds to the indicator of cultural and tourism integration projects in this paper.

4) *Visitors' perception*: Whether the attraction or project is innovative and sustainable, such as the innovative application of the concept of cultural and tourism integration, the richness of tourism resources, and the follow-up evaluation of tourists, etc. This point is mirrored by the indicators of natural landscape and the indicators of tourists' satisfaction in this paper, and this paper considers that although there is a little bit of linkage between the two, there is also a certain degree of discrepancy, so they are listed separately to be analysed.

C. Coefficient of Variation Method

Entropy weighting method is a multi-indicator decision-making method to determine the importance of each indicator in decision-making by calculating the entropy value and weight of each indicator [24]. Entropy weighting method can consider the correlation and importance between indicators by calculating the information entropy of the indicators, so as to reflect more accurately the influence of each indicator on the decision-making, and at the same time, compared with the traditional method of subjective assignment, the entropy weighting method does not require subjective evaluation, but rather, it determines the weights through the amount of information of the data itself, which has the objectivity and scientific nature [25].

This paper considers that the entropy weight method can consider the importance of multiple indicators comprehensively, which can well reflect the multiple factors and indicators involved in the evaluation of tourism attractiveness under the concept of cultural-tourism fusion, and at the same time, the process of adopting the entropy weight method to use information entropy to measure the differences and uncertainties between indicators and to determine the weights of the indicators can better reflect the correlations and influences among the factors of tourism attractiveness under the concept of cultural-tourism fusion. In general, the entropy weight method is comprehensive, objective and widely applicable in the evaluation of tourism attractiveness under the concept of cultural and tourism integration, and can effectively calculate the weights and reflect the impact of cultural and tourism integration on tourism attractiveness. The calculation steps are as follows.

1) *Indicator data forwarding*: Considering that the indicator weight data in this paper all belong to the larger and more important indicators, therefore, this kind of indicator data does not need to be forwarded.

$$x'_{ij} = x_{ij} \quad (1)$$

Where: x'_{ij} - Data matrix elements after normalisation;

x_{ij} -Initial element of the data matrix.

2) *Data standardisation*

$$r_{ij} = \frac{x'_{ij} - \min(x'_j)}{\max(x'_j) - \min(x'_j)} \quad (2)$$

Where: r_{ij} - Normalised data matrix elements;

x'_{ij} -After normalisation the data matrix elements in this paper are the initial matrix elements.

3) *Calculating information entropy*: Noting the matrix obtained from the normalised post-processing as $R = (r_{ij})_{m \times n}$, the information entropy is E_j for a given indicator r_j .

$$E_j = -\frac{1}{\ln m} \sum_{i=1}^m p_{ij} \ln p_{ij} \quad (3)$$

Included among these:

$$p_{ij} = \frac{r_{ij}}{\sum_{j=1}^n r_{ij}} \quad (4)$$

Where: E_j - information entropy;

r_{ij} -Normalised data matrix elements.

If the information entropy of an indicator is smaller, it indicates that the degree of variation of its indicator value is larger, and the amount of information provided is also larger, and it can be considered that the indicator plays a greater role in the comprehensive evaluation.

4) *Calculation of weights*

$$\omega_{ij} = \frac{1 - E_j}{\sum_{j=1}^n (1 - E_j)} \quad (5)$$

Where: E_j - information entropy.

D. *Improvement of the TOPSIS Model*

Based on Table I of this paper, it can be seen that the evaluation of tourism attractiveness based on culture and tourism integration is a process that involves a wide range of indicators, and at the same time the assessment content is redundant, while the TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) model can comprehensively consider a number of indicators, including culture, tourism, economy and other indicators, so as to more comprehensively evaluate the tourism attractiveness. The TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) model can consider multiple indicators, including cultural, tourism, economic and other indicators, to evaluate tourism attractiveness in a more comprehensive way. At the same time, the TOPSIS model is applicable to different types of indicators and different ranges of data, and can be flexibly adjusted and applied according to the characteristics of cultural and tourism resources in different regions. In addition, the advantage of the TOPSIS model is that it can compare the evaluation object with the ideal solution and the negative ideal solution, so as to determine the optimal solution, which is conducive to the improvement of the objectivity and accuracy of the evaluation results. The purpose of this paper is that through the evaluation of TOPSIS model, the advantages and shortcomings of cultural and tourism integration can be better found, and provide scientific basis for the development of cultural and tourism integration, of course, there are some limitations of TOPSIS method, such as the determination of the weights is more subjective, taking this into account, this paper adopts the objective weighting method - entropy weighting method for the determination of weights, and at the same time, considering that the TOPSIS model is lower than the perception of the evaluation results, so it is improved. At the same time, considering that the TOPSIS model has a low perception of the evaluation results in the evaluation, it is improved to carry out the evaluation of tourism attractiveness based on the improved TOPSIS model, and its calculation process is as follows.

1) Calculate the weighted data matrix

$$e_{ij} = \omega_j r_{ij} \quad (6)$$

Where: e_{ij} - weighted matrix elements;

ω_{ij} -weight vector;

r_{ij} -Normalised data matrix elements.

2) Calculate the distance between the weighting matrix and the most value

After processing you can form a data matrix

$$M = (e_{ij})_{m \times n} \quad (7)$$

Define the maximum value of each indicator, i.e., each column, as e_j^+

$$e_j^+ = \max(e_{1j} \cdots e_{nj}) \quad (8)$$

Define the maximum value of each indicator, i.e., each column, as e_j^-

$$e_j^- = \max(e_{1j} \cdots e_{nj}) \quad (9)$$

Define the i th object to be at a distance from the maximum as d_i^+ (positive ideal solution)

$$d_i^+ = \sqrt{\sum_{j=1}^n (e_j^+ - r_{ij})^2} \quad (10)$$

Define the distance of the i th object from the maximum as d_i^- (negative ideal solution)

$$d_i^- = \sqrt{\sum_{j=1}^n (e_j^- - r_{ij})^2} \quad (11)$$

3) Calculation of scores

$$S_i = \frac{d_i^-}{d_i^- + d_i^+} \quad (12)$$

$$Score_i = \frac{S_i}{\max S_i + 0.1} \quad (13)$$

Where: S_i -TOPSIS calculations;

$Score_i$ -Evaluation score.

III. EXAMPLE VALIDATION OF TOURISM ATTRACTIVENESS EVALUATION IN THE PERSPECTIVE OF CULTURE AND TOURISM INTEGRATION BASED ON TOPSIS MODEL

A. Overview of the Study Area

The study area belongs to Mabian County in Sichuan Province, which is located under the jurisdiction of Leshan City, a county full of history, culture and natural scenery. At present, tourism in Mabian County is in a rapid development stage, attracting more and more tourists for sightseeing, holiday and leisure. First of all, Mabian County has rich historical and cultural resources, including ancient religious buildings and traditional folk culture. Guanyin Yan, Chongtianlou, Taiping, Ma'er Mountain Forest Park, and the First Walled City of Liangshan Mountain in the county attract a large number of tourists. In addition, there are some traditional folk activities in the county, such as Sichuan Opera, Sichuan Cuisine and Sichuan

Tea, which attract culture lovers to experience. Secondly, Mabian County is blessed with natural scenery resources, beautiful scenery, with excellent outdoor sports and adventure environment, such as hiking, rock climbing, rafting and other projects are highly favoured by tourists. In addition, it is understood that Mabian County is also actively developing rural tourism, combining local farming culture and idyllic scenery with tourism, providing tourists with a richer tourism experience. In general, the current status of tourism development in Mabian County is good, with abundant tourism resources, attracting a large number of tourists, but how attractive the attractions are based on the view of cultural and tourism integration is still an unknown, so this paper will evaluate and analyse the five tourism zones in Mabian County (Guanyinyan, Chongtianlou, Taiping, Ma'er Mountain Forest Park, and the First Walled Village of Liangshan Mountain, which is hereinafter represented by Attractions 1 - Attractions 5).

B. Entropy Weight Method Weight Calculation

In this paper, the above research object to collect data is shown in Table II, while based on the collection of data according to the Eq. (1-5) calculated to get the entropy weight method of the relevant values and weights are shown in Table III.

C. Analysis of Weighting Results

In this paper, according to the results of weight calculation in Table III, the comprehensive single-indicator weight analysis chart and the analysis chart of hierarchical weight results are drawn by sorting as shown below Fig. 1 and Fig. 2.

Combined with the Fig. 1 and Fig. 2, it can be seen that for the first-level indicators, cultural connotation indicators and natural landscape indicators accounted for 25.97% and 20.59% respectively, which shows that in the evaluation of tourism attractiveness of culture and tourism integration, the tilt towards culture is obvious, and the reason why cultural connotation indicators and natural landscape indicators are more important is that they represent the history of the people and the environment, which are the two important components of the tourism resources respectively. First of all, the cultural connotation indicator represents the richness of a place's history, traditions, arts and customs, etc. Places with rich cultural connotations tend to attract the interest of tourists, who want to feel and experience the local cultural charms by visiting cultural monuments, participating in traditional festivals, tasting local cuisine, etc. Therefore, the cultural connotation indicator is crucial to the attractiveness of culture and tourism integration tourism. The natural landscape indicator represents the attractiveness of a place's natural environment, geographical landscape and ecological resources, etc. Places with beautiful natural landscape can often make tourists feel the wonder and beauty of nature, and they want to enjoy the beauty of nature through viewing natural scenery, participating in outdoor activities, experiencing ecological farming, etc. Therefore, the natural landscape indicator is also very important for the attractiveness of the integrated tourism of culture and tourism. Therefore, the natural landscape indicator is also very important for the attraction of cultural tourism integration. This also shows that when a place has both rich cultural connotations and

beautiful natural landscapes, it tends to attract more tourists to come to experience and explore.

TABLE II. DATA ON THE STUDY POPULATION

Secondary indicators	Attractions 1	Attractions 2	Attractions 3	Attractions 4	Attractions 5
Number of cultural heritages	85	82	81	70	78
Status of protection of cultural heritage	90	87	86	76	87
Richness of cultural activities	75	70	73	80	70
Development of cultural industries	75	70	72	87	76
Accessibility	80	83	86	70	78
Accommodation facilities	78	81	88	76	87
Tourism reception capacity	86	89	87	83	75
Service level of guided tours	88	91	90	81	70
Quality of the natural environment	87	81	78	89	70
Natural landscape features	90	86	87	82	81
Ecotourism resources	78	73	75	87	75
Development of Cultural and Creative Industries	87	90	75	70	75
Culture and Tourism Integration Construction	70	80	80	70	72
Cultural and Tourism Integration Activities Organised	76	80	78	81	86
traveller's comment	80	75	83	89	88
Tourist return rate	75	75	81	91	82
Word-of-mouth communication	80	76	89	87	87

TABLE III. RESULTS OF WEIGHTING CALCULATIONS

Secondary indicators	Information entropy	weights	Tiered weighting	Level 1 indicators	Weights
Number of cultural heritages	0.8514	0.0589	0.2268	Indicators of cultural content	0.2597
Status of protection of cultural heritage	0.8458	0.0611	0.2354		
Richness of cultural activities	0.9216	0.0311	0.1197		
Development of cultural industries	0.7262	0.1086	0.4181		
Accessibility	0.8793	0.0479	0.2169	Tourism infrastructure indicators	0.2207
Accommodation facilities	0.8820	0.0468	0.2120		
Tourism reception capacity	0.8872	0.0447	0.2027		
Service level of guided tours	0.7950	0.0813	0.3684		
Quality of the natural environment	0.8214	0.0708	0.3440	Natural landscape indicators	0.2059
Natural landscape features	0.8542	0.0578	0.2809		
Ecotourism resources	0.8053	0.0772	0.3751		
Development of Cultural and Creative Industries	0.8825	0.0466	0.3215	Indicators for cultural and tourism integration projects	0.1449
Culture and Tourism Integration Construction	0.8463	0.0609	0.4206		
Cultural and Tourism Integration Activities Organised	0.9058	0.0374	0.2579		
traveller's comment	0.8688	0.0520	0.3081	Indicators of tourist satisfaction	0.1688
Tourist return rate	0.9229	0.0306	0.1812		
Word-of-mouth communication	0.7826	0.0862	0.5107		

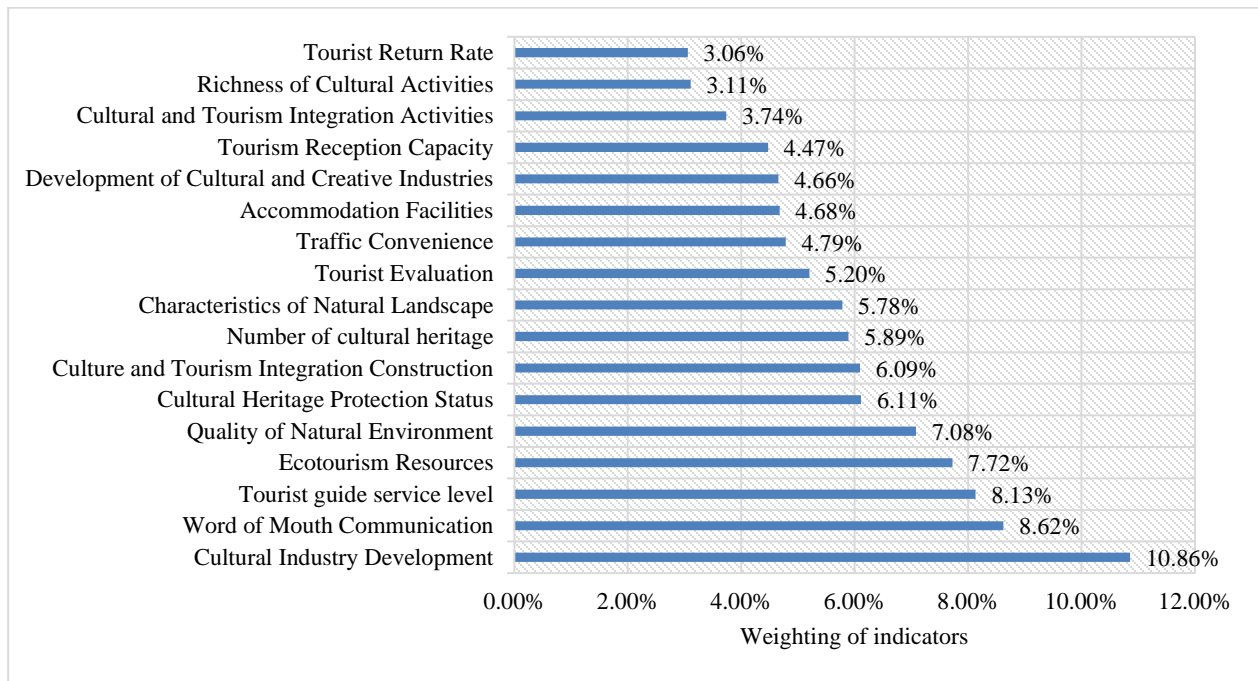


Fig. 1. Histogram of the ranking of weighting results.

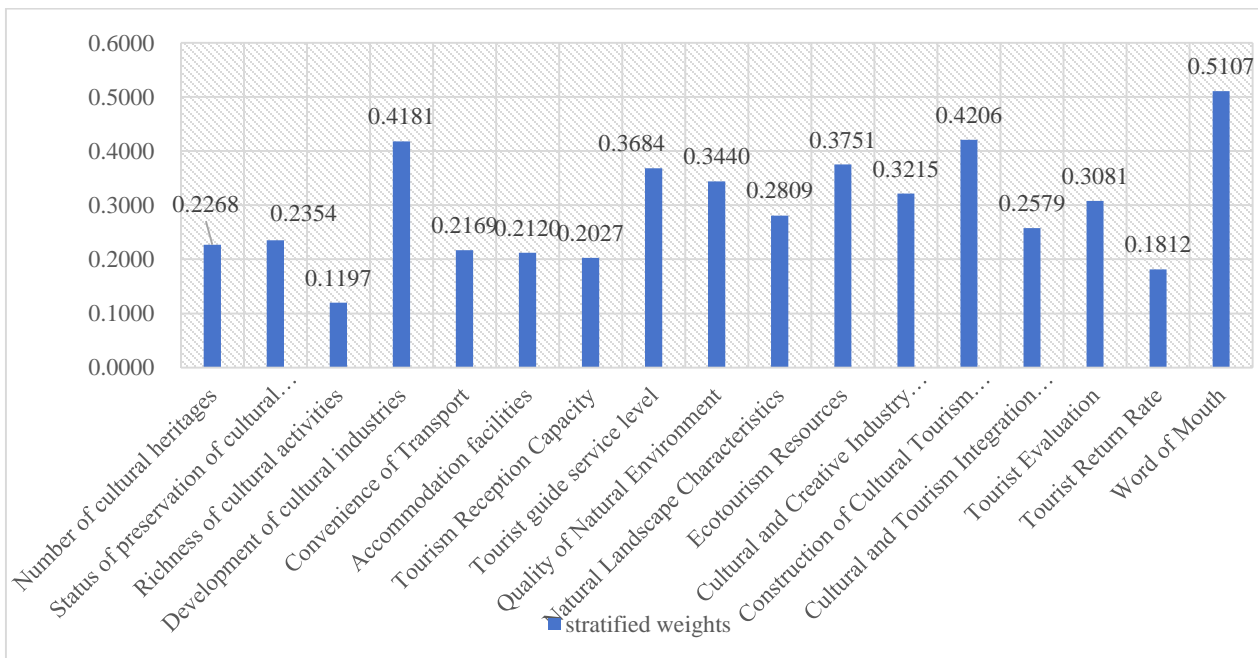


Fig. 2. Histogram of stratified weights.

And according to the calculation results of single indicators and bar charts, it can be seen that the development of cultural industry, word-of-mouth communication, tour guide service level, eco-tourism resources, and the quality of the natural environment are in the forefront, accounting for 10.86 %, 8.62 %, 8.13 %, 7.72 %, 7.08 %, which can be seen to belong to the indicators of cultural connotation, tourists' satisfaction, tourism infrastructure, and the natural landscape, respectively. This shows that even though the first-level indicators are not considered, the single indicator weights still indicate the importance of the indicators under the first-level indicators,

which are analysed as follows: in the evaluation of tourism attractiveness of culture and tourism integration, the cultural industry development, word-of-mouth transmission, tour guide service level, ecotourism resources and natural environment quality indicators are all more important because they each represent different aspects of tourism purposes, and play an important role in enhancing the tourist. The reason is that they represent different aspects of tourism purposes and play an important role in enhancing tourist experience and attracting tourists. Firstly, the cultural industry development indicator represents the development level of a place in terms of cultural

creative industries, cultural festivals and cultural product development. A place with rich cultural industries can provide tourists with diversified cultural experiences and cultural products, enhance their sense of participation and interactivity, and thus improve tourism attractiveness. Secondly, word-of-mouth (WOM) indicators represent tourists' satisfaction and experience of a destination. Good WOM means that tourists praise and recommend the destination, which can attract more tourists to come. Word-of-mouth communication is especially important in today's social media era, and tourists' favourable comments and sharing can directly influence other potential tourists' choices. The tour guide service level indicator represents the level of tourism service and the quality of tourists' experience in the destination. Quality tour guide service can provide tourists with a better travelling experience and enhance their knowledge and understanding of the destination, thus increasing their satisfaction and loyalty to the destination. Finally, the ecotourism resources indicator and the natural environment quality indicator represent the natural environment

and ecological protection of the destination. In today's context of environmental protection and sustainable development [22], rich ecotourism resources and good quality of the natural environment can attract more tourists who are concerned about environmental protection, and also meet the contemporary demand for healthy, leisure and environmentally friendly tourism.

The results of the above weighting analyses show that important factors need to be considered comprehensively in tourism development and evaluation in order to enhance the competitiveness and attractiveness of tourism destinations.

D. The TOPSIS Model

1) *Model evaluation:* The TOPSIS model evaluation of the study area was carried out according to the Eq. (6)-Eq. (13), and the results of the calculation of the first-level indicators of the five study objects and their attractiveness evaluation are now presented in Table IV.

TABLE IV. EVALUATION RESULTS FOR THE STUDY AREA

place of interest (tourism)	Indicators of cultural content			Tourism infrastructure indicators		
	<i>d+vector</i>	<i>d-vector</i>	<i>score</i>	<i>d+vector</i>	<i>d-vector</i>	<i>score</i>
Attractions 1	0.0297	0.0288	68.3038	0.0152	0.0391	69.0666
Attractions 2	0.0427	0.0205	44.9665	0.0089	0.0468	80.6586
Attractions 3	0.0378	0.0195	47.1028	0.0029	0.0476	90.4069
Attractions 4	0.0258	0.0423	86.1356	0.0315	0.0231	40.5971
Attractions 5	0.0296	0.0225	59.8747	0.0448	0.0160	25.2612
place of interest (tourism)	Natural landscape indicators			Indicators for cultural and tourism integration projects		
	<i>d+vector</i>	<i>d-vector</i>	<i>score</i>	<i>d+vector</i>	<i>d-vector</i>	<i>score</i>
Attractions 1	0.0198	0.0364	72.0567	0.0306	0.0295	54.3214
Attractions 2	0.0343	0.0221	43.5494	0.0444	0.0086	89.3314
Attractions 3	0.0335	0.0181	38.9272	0.0269	0.0294	51.0423
Attractions 4	0.0118	0.0470	88.8821	0.0072	0.0446	14.8057
Attractions 5	0.0463	0.0043	36.2356	0.0177	0.0337	36.7036
place of interest (tourism)	Indicators of tourist satisfaction			attractiveness rating		
	<i>d+vector</i>	<i>d-vector</i>	<i>score</i>	<i>d+vector</i>	<i>d-vector</i>	<i>score</i>
Attractions 1	0.0413	0.0102	19.0468	0.0117	0.0146	80.6141
Attractions 2	0.0321	0.0249	41.8058	0.0154	0.0140	69.3502
Attractions 3	0.0249	0.0264	49.2807	0.0130	0.0144	76.3585
Attractions 4	0.0027	0.0461	90.4190	0.0119	0.0170	85.4721
Attractions 5	0.0206	0.0314	57.8215	0.0166	0.0097	53.6475

2) *Analysis of results:* Guanyinyan, Chongtianlou, Taiping, Maer Mountain Forest Park, Liangshan First Walled City scored 80.6141, 69.3502, 76.3585, 85.4721, 53.6475 in this evaluation, it can be seen that Chongtianlou and Liangshan First Walled City scored relatively low, based on the results of the attractiveness evaluation, based on the rating results of the two attractions mentioned above, this paper carries out the secondary survey analysed after the visit. First of all, the main reason for Chongtianlou is that the cultural connotation is not deep enough and there are certain problems in dissemination, Chongtianlou as a cultural attraction, its history, traditions, folklore and other aspects of cultural connotation is not rich enough and insufficient publicity, through the evaluation of the

first level of indicators can be seen, its cultural connotation indicators score is very low, so it is necessary to strengthen the publicity and properly enrich their own advantages as a cultural classic. Mabian County Liangshan First Walled City attractions scored low mainly because of the scenic area's infrastructure is not perfect, the level of service is not high, including car parks, toilets, guide services, transportation, etc., and at the same time, the scenic area's cultural and tourism integration projects are not diversified enough and innovative enough, and are more conventional, if the Liangshan First Walled City continues to lack of innovative projects with local culture, traditional industries and other fusion, will affect the attractiveness of the scenic area to tourists, therefore, it is necessary to improve the

cultural connotation indicators. Attractive to tourists, so to improve the rating of the scenic area, it is necessary to improve the infrastructure, the introduction of innovative cultural and tourism integration projects.

IV. CONCLUSION

This study evaluates the tourism attractiveness in the perspective of culture and tourism integration based on the TOPSIS model, and the results show that the model can effectively assess the attractiveness of tourism destinations and provide a scientific basis for tourism development, and the results of the evaluation of tourism attractiveness through the perspective of culture and tourism integration show that the integration of culture and tourism resources plays an important role in enhancing the attractiveness of tourism destinations, which provides a It provides theoretical support for the development of culture and tourism integration. At the same time, this study also found that under the perspective of culture and tourism integration, the evaluation of tourism attractiveness needs to consider the integration of cultural heritage and tourism experience, in order to achieve the sustainable development of tourism destinations to further improve the attractiveness of existing tourism resources, and at the same time, it is necessary to strengthen the cultural and artistic activities of attractions with cultural heritage, and to make a unique tourism area.

In view of the demand for the development of cultural and tourism integration, more field research and case analyses can be considered in the future to explore the evaluation methods of tourism attractiveness in different regions and cultural backgrounds, so as to enrich the research results. At the same time, we can also combine big data and artificial intelligence technology to build a more accurate tourism attractiveness evaluation model under the perspective of culture and tourism integration, so as to achieve dynamic data collection and dynamic real-time evaluation, and to provide more scientific support for tourism development as well as suggestions for development decisions.

REFERENCES

- [1] Canavan B. Tourism culture: nexus, characteristics, context and sustainability[J]. *Tourism management*, 2016, 53: 229-243.
- [2] Tang, C., Liu, Y., Wan, Z., & Liang, W. (2023). Evaluation system and influencing paths for the integration of culture and tourism in traditional villages. *Journal of Geographical Sciences*, 33(12), 2489-2510. *Journal of Geographical Sciences*, 33(12), 2489-2510.
- [3] Ma, Y., & Chen, Y. (2023). The Inspiration of the Fusion of Chinese and Western Cultures for the Development of Macau City. *Journal of Sociology and Ethnology*, 5(11), 162-166.
- [4] zhu, h., liu, j. m., tao, h., & zhang, j. (2015). Evaluation and spatial analysis of tourism resources attraction in Beijing based on the internet information. *Journal of Natural Resources*, 30(12), 2081-2094.
- [5] Kenedi, K., Sukmawan, I., & Laksana, A. (2022). Evaluation of the economic potential of coastal tourism strategic area of anyer tourism-cinangka. *Jurnal Ekonomi*, 11(01), 611-618.
- [6] Cherapanukorn, V., & Sugunnasil, P. (2022). Tourist attraction satisfaction factors from online reviews. a case study of tourist attractions in Thailand. *journal of environmental management & Tourism*, 13(2), 379-390.
- [7] Cao, Q., Sarker, M. N. I., Zhang, D., Sun, J., Xiong, T., & Ding, J. (2022). Tourism competitiveness evaluation: evidence from mountain tourism in China. *Frontiers in Psychology*, 13, 809314.
- [8] Wang, S., Wang, J., Shen, W., & Wu, H. (2023). The evaluation of tourism service facilities in Chinese traditional villages based on the living protection concept: Theoretical framework and empirical case study. *Journal of Asian Architecture and Building Engineering*, 22(1), 14-31.
- [9] Meng Jia. Research on the Attractiveness Evaluation of County Tourism of Old Revolutionary Sites [D]. Hebei Normal University, 2023. DOI:10.27110/d.cnki.ghsfu.2023.000446.
- [10] Yang, S., & Kong, X. (2022). Evaluation of Rural Tourism Resources Based on AHP-Fuzzy Mathematical Comprehensive Model. *Mathematical Problems in Engineering*, 2022 (1), 7196163.
- [11] Gu, X., Hunt, C. A., Jia, X., & Niu, L. (2022). Evaluating nature-based tourism destination attractiveness with a Fuzzy-AHP approach. *Sustainability*, 14(13), 7584.
- [12] HUA Zhiqiang, ZHANG Chunsheng, CHEN Liying, et al. Comprehensive evaluation of tourism resource attractiveness based on principal component analysis method[J]. *Journal of Hubei College of Nationalities (Natural Science Edition)*, 2015, 33(04):399-401. Gu, X., Hunt, C. A., Jia, X., & Niu, L. (2022). Evaluating nature-based tourism destination attractiveness with a Fuzzy-AHP approach. *sustainability*, 14(13), 7584.
- [13] Hoang, H. T., Truong, Q. H., Nguyen, A. T., & Hens, L. (2018). Multicriteria evaluation of tourism potential in the central highlands of vietnam: combining geographic information system (GIS), analytic hierarchy process (AHP) and principal component analysis (PCA). *Sustainability*, 10(9), 3097.
- [14] Gu, X., Hunt, C. A., Jia, X., & Niu, L. (2022). Evaluating nature-based tourism destination attractiveness with a Fuzzy-AHP approach. *Sustainability*, 14(13), 7584.
- [15] Hou Xiaomin. Research on the Evaluation of Tourism Attractiveness of Destinationless Cruise Products [D]. Guizhou Normal University, 2023. Vinogradova, M. V., Larionova, A. A., Maloletko, A. N., & Kaurova, O. V. (2016).
- [16] The use of MBO (management of objectives) method of attraction and evaluation of effectiveness of investments to the tourism and hospitality. *International review of management and Marketing*, 6(2), 241-246.
- [17] Saputro, K. E. A., Hasim, Karlinasari, L., & Beik, I. S. (2023). Evaluation of Sustainable Rural Tourism Development with an integrated approach using MDS and ANP methods: case study in Ciamis, West Java, Indonesia. *Sustainability*, 15(3), 1835.
- [18] Lu, W. A. N. G., Ziruo, H. U. A. N. G., Le, Y. U., & Zhizhong, N. I. N. G. (2024). Evaluation of the Development Resilience of Tourist Attractions under the Influence of Major Public Health Events. *Journal of Resources and Ecology*, 15 (3), 698-710.
- [19] Huang Lan. Research on Tourism Attraction Evaluation of West Lake Famous Scenic Area Based on IPA Analysis [D]. Northwest Normal University, 2022. DOI:10.27410/d.cnki.gxbfu.2022.002177.
- [20] Wang, Yumei, Peide Liu, and Yiyu Yao. "BMW-TOPSIS: A generalised TOPSIS model based on three-way decision." *information sciences* 607 (2022): 799-818.
- [21] Ramakrishnan, Krishnapuram Ravi, and Shankar Chakraborty. "A cloud TOPSIS model for green supplier selection." *Facta Universitatis, Series. Mechanical Engineering* 18.3 (2020): 375-397.
- [22] Zhao, Ding-Yi, Yu-Yu Ma, and Hung-Lung Lin. "Using the entropy and TOPSIS models to evaluate sustainable development of islands: a case in China." *Sustainability* 14.6 (2022): 3707.
- [23] Luyen, Le Anh, and Nguyen Van Thanh. "Logistics service provider evaluation and selection: hybrid servqual-fahp-topsis model." *Processes* 10.5 (2022): 1024.
- [24] HUANG Tianyuan, WANG Shunsheng. Evaluation of science popularisation capacity of water conservancy scenic area based on entropy power method-AHP empowerment[J]. *Water Resources Planning and Design*, 2024, (06):94-98+120.
- [25] Li, Z., Luo, Z., Wang, Y., Fan, G., & Zhang, J. (2022). Suitability evaluation system for the shallow geothermal energy implementation in region by Entropy Weight Method and TOPSIS method. *Renewable Energy Renewable Energy*, 184, 564-576.