

VIKOR-based Method for Assessing the Degree of Development of Film and Television City Tourism Resources in An Intuitively Fuzzy Environment

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Abstract: This paper proposes a multi-attribute decision-making method based on VIKOR in an intuitionistic fuzzy environment to evaluate the extent conducted tourism resources development in film and television cities. Firstly, the decision matrix is normalized; secondly, the VIKOR method is introduced into the performance assessment to calculate the individual regret value and group utility value, and the evaluation objects are ranked in a meritocratic way; finally, the effectiveness and scientificity of the method are proved by example analysis.

Keywords: Degree of development; Tourism resources; Film city; Intuitionistic fuzzy set; VIKOR.

1. Preamble

Film and TV City is a professional organization developed from a film and TV shooting base, with its main business covering filming and production of film and TV dramas, development of filming scenic spots and operation of related tourism resources. It integrates a variety of functions, including filming and production, ecological vacation, sightseeing and rehabilitation, forming a comprehensive base for film and television tourism. The degree of development of the film and television city not only profoundly affects the creation and shooting of film and television works, but also is closely related to the development of the neighboring industry chain, and even directly determines the economic development of the region where it is located. Because of this, the study of film and television cities has attracted extensive attention from the academic community. Wang Shuchun et al. [1] believe that it is necessary to enrich the tourism products of scenic spots, update the content of film and television tourism, etc. Meng Tiexin and Yuan Shuqi [2] proposed that the relevant operating units should strengthen market research and take the initiative to develop innovative tourism products that cater to consumer tastes. Wang Wei[3] It is pointed out that in order to promote the healthy, sustainable and stable development of the film and television city, tourism operators must do a good job of rational planning. Wang Lang and Guo Minqing[4] They believe that for tourist attractions, it is necessary to make full use of the valuable literary resources to serve the contemporary society and people. Ren Wenyan[5] Discovered that Qinhan Film and TV City must adhere to the national culture as the core, and reasonably construct and layout excursion projects in order to give full play to the unique cultural advantages of film and TV tourism. Xiao Menglin[6] Insisting on the development of the dual main industries of film and television and culture and tourism, vigorously developing film and television tourism, study tourism and festival tourism. Liu Wenhua and Xue Yaowen[7] It is proposed that the development of film and television city should make full use of the resources of the film and television city, improve the film and television industry chain, and take the route of differentiation. At present, the research on film and television city mainly focuses on the level of "film

and television +", but neglects the development and evaluation of its internal resource environment. By evaluating the degree of development of tourism resources in film and television cities, we can better define the construction purpose of film and television cities, plan a reasonable future direction, and thus promote the sustainable development of film and television cities.

The Fourteenth Five-Year Plan for Tourism Development clearly states that the principle of combining standardization and personalization should be adhered to, with optimization of the structure of tourism products as the core, and a creative tourism product system should be constructed. The needs of various groups should be taken into full consideration, and efforts should be made to introduce more customized tourism products and routes, and to provide experiential and interactive tourism projects. In addition, the importance of tourism resource development is emphasized, and localities are required to actively explore and utilize all kinds of tourism resources as a way to promote the in-depth integration and development of the country's cultural and tourism industries, accelerate the construction of the national demonstration zone for the integrated development of the cultural and tourism industries, and inject a new impetus into the high-quality development of the tourism industry. Lin Mingshui and Hu Xiaopeng et al.[8] believe that the combination of effective market and active government establishes the brand of tourist places, and can make full use of the spatial effect of flow economy to promote the collaborative development of regional tourism. Ren Yisheng[9] et al. Rational development and utilization of tourism resources is a necessary precondition for the formulation of tourism policy, and reasonable spatial distribution of tourism resources can promote the sustainable development of tourism. In addition, the development of tourism resources also requires the cooperation of many parties, Zhong Hailian et al.[10] Zhong Hailian et al. propose practices for rational planning and development of tourism resources from the perspectives of governments at all levels, local residents and various interests. In the face of extreme terrain and complex environment, Qin Xuxue et al.[11] found that the role of special natural environments in the development of tourism resources should be rationally utilized in order to promote the healthy

development of tourism.

Since its introduction in 1998, the VIKOR decision-making method, an innovative trade-off ranking method, has been used to comprehensively and fairly evaluate and rank a limited number of decision options by maximizing group utility and minimizing individual regret. As a superior tool in the field of multi-criteria decision making (MCDM), the VIKOR method has successfully solved a series of evaluation and decision-making challenges in many industries. Li Jian et al.[12] The fuzzy VIKOR method is used to give a ranking of lean, agile, and sensitive supply chain paradigm choices, and the automobile manufacturing industry is used as an example to show that the model can provide companies with the ability to choose methods that match their own operation modes. Yang Shanliang et al.[13] Extending the traditional VIKOR method to the intuitionistic fuzzy environment and applying the extended VIKOR method to solve the equipment evaluation preference problem by combining the relevant theories of intuitionistic fuzzy, which provides a scientific and reasonable decision-making framework for solving the equipment command decision problem. Yuan Yu et al.[14] proposed a hybrid multi-criteria group decision-making mathematical model to address the characteristics of mixed decision-making information and uncertainty of subjective weights in the supplier problem. Therefore, this paper provides a scientific and reasonable decision-making solution to the problem of efficient and reasonable development of tourism in film and television city by evaluating the degree of development of tourism resources in film and television city and solving the problem of efficient and reasonable development of tourism in film and television city after constructing a film and television city tourism resources development index system through the method of literature analysis and through the multi-attribute decision-making method based on VIKOR under the intuitional fuzzy environment. Starting from the five aspects of service quality, number of facilities, site size, popularity and construction cost, the degree of tourism resource development of different film and TV cities is evaluated, and the best case of film and TV city in terms of tourism resource development is selected among four different film and TV cities. Through this method, the assessment can, to a certain extent, give some help to the development of tourism resources in film and television cities, thus promoting the high-quality and sustainable development of tourism in film and television cities.

2. Preliminaries

2.1. Fuzzy set

Scholar Zedah proposed the fuzzy set in 1965[15] concept and defined a fuzzy set as a class of objects with continuous affiliation classes. Such a set is characterized by an affiliation function that assigns each object an affiliation rank between 0 and 1.

Definition 1 Let X be a non-empty set, then $A = \{ \langle x, \mu_A(x) \rangle \mid 0 \leq \mu_A(x) \leq 1, x \in X \}$ is a fuzzy set (FS) on the set X , where $\mu_A(x)$ denotes the degree of affiliation of the element x in the set X belonging to A [2].

2.2. Intuitionistic fuzzy set

Definition 2 Let X be a non-empty set, then the intuitionistic fuzzy set (IFS) on the set X is denoted as

$$A = \{ \langle x, \gamma_A(x), \nu_A(x) \rangle \mid 0 \leq \gamma_A(x) + \nu_A(x) \leq 1, x \in X \} .$$

Where $\gamma_A(x)$ and $\nu_A(x)$ denote the degree of membership and non-membership, respectively, of $x \in X$ belonging to the set A and $\gamma_A(x): X \rightarrow [0,1]$, $\nu_A(x): X \rightarrow [0,1]$ [16].

Property 1 Let $A = \langle \gamma_A, \nu_A \rangle$, $B = \langle \gamma_B, \nu_B \rangle$ be any two intuitionistic fuzzy numbers, $\lambda > 0$, then the properties of the operations between them are[17]:

$$(1) A + B = (\gamma_A + \gamma_B - \gamma_A \gamma_B, \nu_A \cdot \nu_B);$$

$$(2) AB = (\gamma_A \cdot \gamma_B, 1 - (1 - \nu_A) \cdot (1 - \nu_B));$$

$$(3) \lambda A = (1 - (1 - \gamma_A)^\lambda, \nu_A^\lambda);$$

$$A^\lambda = (\gamma_A^\lambda, 1 - (1 - \nu_A)^\lambda).$$

Definition 3 Let the cost-based indicator $A = \langle \gamma_A, \nu_A \rangle \in IFN$ be the result of the standardization of \tilde{A} by A , then

$$\tilde{A} = [\nu_A, \gamma_A] \quad (1)$$

Definition 3 Let $A = \langle \gamma_A, \nu_A \rangle$, $B = \langle \gamma_B, \nu_B \rangle$ be any two intuitionistic fuzzy numbers, then the Hamming distance between them is[18]:

$$d_H(A, B) = \frac{1}{2} (|\gamma_A - \gamma_B| + |\nu_A - \nu_B| + |\gamma_B + \nu_B - \gamma_A - \nu_A|) \quad (2)$$

2.3. VIKOR method

The VIKOR method is a compromise ranking method proposed by Opricovic in 1998, which performs a compromise ranking of evaluation objects by calculating the values of maximizing group utility and minimizing individual regret.[19] The VIKOR method requires determining the positive ideal solution (PIS) and negative ideal solution (NIS) and selecting the best based on the magnitude of the distance between the metric value of the evaluated object and the ideal metric value. The VIKOR method is based on the following form of L_p measure:

$$L_p = \left\{ \sum_{i=1}^n \left[\frac{\omega_i (f_i^* - f_{ij})}{(f_i^* - f_i^-)} \right]^p \right\}^{\frac{1}{p}} \quad (3)$$

Among them, $1 \leq p < \infty$, $j = 1, 2, \dots, n$, f_{ij} represent the values of decision evaluation indexes, ω_j is the weight of index attributes, and f_i^* and f_i^- represent the positive ideal value and negative ideal value respectively.

3. Methodological Step

Denote $M = \{1, 2, \dots, m\}$ and $N = \{1, 2, \dots, n\}$. Denote $A = \{A_1, A_2, \dots, A_m\}$ as the set of m evaluation objects, where A_i denotes the i th evaluation object, $i \in M$; the set of attributes is denoted as $C = \{C_1, C_2, \dots, C_n\}$, where C_j denotes the j th attribute, $j \in N$. $\omega = (\omega_1, \omega_2, \dots, \omega_n)$ is the

weight vector of attributes, where ω_j is the weight of attribute C_j and satisfies $\omega_j \geq 0$, $\sum_{j=1}^n \omega_j = 1$. Let the original decision matrix be $X = [x_{ij}]_{m \times n}$, where x_{ij} is the intuitionistic fuzzy number, which represents the result of evaluating the object A_i for the attribute C_j . The constructed raw decision evaluation matrix is shown in Table 1.

Table 1. Original decision matrix

	C_1	C_2	C_j	C_n
ω	ω_1	ω_2	ω_j	ω_n
A_1	x_{11}	x_{12}	x_{1j}	x_{1n}
A_2	x_{21}	x_{22}	x_{2j}	x_{2n}
A_i	x_{i1}	x_{i2}	x_{ij}	x_{in}
A_m	x_{m1}	x_{m2}	x_{mj}	x_{mn}

Step 1: Normalize the decision matrix

According to targeting the negative type indicators, according to the formula(1). The original decision matrix is normalized. Let \tilde{x}_{ij} be the result of normalization, then the normalized matrix is denoted as $\tilde{X} = [\tilde{x}_{ij}]_{m \times n}$.

Step 2: Determine positive and negative ideal points

Determine the positive and negative ideal points for each alternative evaluation object under different indicator attributes, defining the attribute value that the decision maker is most satisfied with for each attribute as the positive ideal point (PIS), and the attribute value that the decision maker is most dissatisfied with as the negative ideal point (NIS), there:

$$\begin{cases} \tilde{x}_j^+ = \langle \max_{1 \leq i \leq m} \{\gamma_{ij}\}, \min_{1 \leq i \leq m} \{\nu_{ij}\} \rangle \\ \tilde{x}_j^- = \langle \min_{1 \leq i \leq m} \{\gamma_{ij}\}, \max_{1 \leq i \leq m} \{\nu_{ij}\} \rangle \end{cases} \quad (4)$$

Step 3: Calculate group utility values and individual regret values

Calculate the group utility value S_i and the individual regret value R_i for each evaluation subject:

$$S_i = \sum_{j=1}^n \omega_j (\tilde{x}_{ij}^+ - \tilde{x}_{ij}^-) / (\tilde{x}_{ij}^+ - \tilde{x}_{ij}^-) \quad (5)$$

$$R_i = \max_{1 \leq j \leq n} [\omega_j (\tilde{x}_j^+ - \tilde{x}_{ij}^-) / (\tilde{x}_j^+ - \tilde{x}_j^-)] \quad (6)$$

Step 4: Solving for trade-off values

Based on S_i and R_i the trade-off decision evaluation value Q_i is obtained:

$$Q_i = v \frac{(S_i - S^+)}{S^- - S^+} + (1-v) \frac{(R_i - R^+)}{R^- - R^+} \quad (7)$$

where $S^+ = \min S_i$, $S^- = \max S_i$, $R^+ = \min R_i$,

$R^- = \max R_i$. v is the tradeoff coefficients and $0 \leq v \leq 1$.

Step 5: Compromise ranking of evaluation objects

According to S_i , R_i and Q_i are ranked from smallest to largest, and if both condition 1 and condition 2 are satisfied, the evaluation objects are ranked according to the size of the compromise evaluation value Q_i , and the smaller Q_i is, the better the evaluation object is. If only condition 1 is satisfied, then H_1 and H_2 are all the compromise evaluation objects; if condition 1 cannot be satisfied and condition 2 is satisfied, then it can be determined that the overall evaluation of the evaluation objects that do not satisfy condition 1 are all optimal.

Condition 1 : $Q(Y_2) - Q(Y_1) \geq DQ$, $DQ = 1/(n-1)$; where H_1 is the optimal solution sorted according to Q_i and H_2 is the suboptimal solution sorted according to Q_i .

Condition 2: Sort by S_i or R_i H_1 is the object that comes first in line^[20].

4. Case Study

A local government is ready to assess the degree of development of tourism resources in film and television cities in order to promote the construction of local film and television city tourism resorts. The government identifies four film and TV cities (A_1, A_2, A_3, A_4) as alternatives through research, and assesses them in five aspects: service quality C_1 , number of facilities C_2 , site size C_3 , visibility C_4 , and construction cost C_5 , of which C_5 is a negative indicator, and the weights of each indicator have been determined in advance. In order to make the decision more rational, the person in charge of the intuition fuzzy set as the type of assessment data, established as Table1. The intuitionistic fuzzy performance assessment matrix shown, and according to the method of this paper to select the most suitable for investment and development of the film and television city.

Table1. Intuitionistic Fuzzy Performance Assessment Matrix

	C_1	C_2	C_3	C_4	C_5
ω	0.2	0.3	0.3	0.1	0.1
A_1	<0.3,0.1>	<0.5,0.2>	<0.7,0.3>	<0.7,0.3>	<0.2,0.5>
A_2	<0.8,0.2>	<0.7,0.2>	<0.6,0.4>	<0.8,0.2>	<0.4,0.6>
A_3	<0.4,0.2>	<0.6,0.2>	<0.7,0.1>	<0.6,0.1>	<0.3,0.6>
A_4	<0.5,0.3>	<0.5,0.5>	<0.6,0.3>	<0.7,0.3>	<0.3,0.7>

Step 1: Normalize the original matrix to obtain the normalized performance evaluation matrix, see Table2

Table2. Normalized Intuitionistic Fuzzy Performance Assessment Matrix

	C_1	C_2	C_3	C_4	C_5
ω	0.2	0.3	0.3	0.1	0.1
A_1	<0.3,0.1>	<0.5,0.2>	<0.7,0.3>	<0.7,0.3>	<0.5,0.2>
A_2	<0.8,0.2>	<0.7,0.2>	<0.6,0.4>	<0.8,0.2>	<0.6,0.4>
A_3	<0.4,0.2>	<0.6,0.2>	<0.7,0.1>	<0.6,0.1>	<0.6,0.3>
A_4	<0.5,0.3>	<0.5,0.5>	<0.6,0.3>	<0.7,0.3>	<0.7,0.3>

Step 2: According to the formula (4) Determine the positive and negative ideal points of each indicator, then the positive and negative ideal points of indicators C_1 to C_5 are as follows **Table 3** The positive and negative ideal points of the indicators to are shown in Table 4.

Table 3. Positive and negative ideal points for each indicator

	C_1	C_2	C_3	C_4	C_5
PIS	<0.8,0.1>	<0.7,0.2>	<0.7,0.1>	<0.8,0.1>	<0.7,0.2>
NIS	<0.3,0.3>	<0.5,0.5>	<0.6,0.4>	<0.6,0.3>	<0.5,0.4>

Step 3: Calculate the group utility value S_i and the individual regret value R_i , and at the same time take 0.5 for the trade-off coefficient ν to calculate the trade-off evaluation value Q_i , and the results are shown in **Table 4** The results are shown in Table 5.

Table 4. S, R, and Q values for each evaluation object

	S	R	Q
A_1	0.8000	0.2000	0.6429
A_2	0.4900	0.3000	0.6026
A_3	0.4100	0.1600	0.0000
A_4	0.7700	0.3000	0.9615

Step 4: Rank the suppliers according to the size of the trade-off value, the smaller the value of Q , the better the evaluation target. According to the results, it can be seen that the evaluation object is ranked from the best to the worst $A_3 \succ A_2 \succ A_1 \succ A_4$. The evaluation target A_3 is selected as a film city with a better degree of development according to the principle of eclectic ranking of evaluation targets, and the conditions (1) and (2) are satisfied at the same time.

5. Conclusion

This paper constructs the VIKOR method to evaluate the degree of tourism resource development of film and television city, firstly, normalize the original matrix; secondly, calculate the compromise evaluation value of each evaluation object through individual regret value and group utility value, and rank them optimally; finally, the effectiveness of the method is fully proved in the example analysis, so that the method proposed by this paper can promote the tourism resources of film and television city to a certain extent. development, and promote the sustainable development of the film and television city.

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