International Journal for Housing Science and Its Applications
Publish August 6, 2025. Volume 46, Issue 3 Pages 5457-5465

https://doi.org/10.70517/ijhsa463471

Optimizing the Role Mechanism of City Image IP Design on Brand Communication Effect Using Grey Correlation Analysis

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Abstract In the era of digitization, creating city image IP is the key to enhance the effect of the city's external publicity. This paper systematically analyzes the factors influencing the competitiveness of city IP brand and constructs a comprehensive evaluation index system. The method of approximating ideal solution ranking (TOPSIS) is chosen to calculate the distance between city image IP design alternatives and positive and negative ideal solution solutions to find the optimal solution. Using the gray correlation analysis method, the gray correlation of each key index is calculated to mine the key factors of urban image IP optimization. The results show that the weight of the core factor is 0.35, and the weight of tourism resources and urban environment is 0.20. The comprehensive evaluation index of the brand communication effect of each city image IP D_i improves from 0.314247 to 0.921435. The grey correlation of the four factors of the first-level index layer is always greater than 0.500, and the standard deviation of the branding factor has the smallest value of 0.58. The comprehensive use of the TOPSIS method and the grey correlation analysis method to find the optimal factors. TOPSIS method and gray correlation analysis can find the optimal city image IP design scheme and effectively improve the city brand communication effect.

Index Terms city image IP, TOPSIS method, positive and negative ideal solutions, comprehensive assessment index, gray correlation analysis

I. Introduction

Cities are the products of human economic, political, cultural and other social activities, and urban construction is not only an environmental problem, but also a philosophical problem and a civilization problem [1]. If a city wants to survive and prosper in the long run, it must set up its own good image, and if the city does not have a good image or an ambiguous image, it is difficult to develop and progress in the information society [2], [3]. Being in today's brand economy era, brand is the guarantee of productivity, communication, competitiveness and development, so it is especially important to observe the brand development of cities from the perspective of city image IP design [4], [5].

The so-called branding is to let people understand a certain product, a certain region at the same time through its extended design, to achieve the understanding of the company, the city's overall image [6]. City image branding design should not just decorate the city, but should be built on the basis of the concept of urban construction, make full use of the theory and method of branding design, image planning and design of the city of a whole set of visual recognition system [7]-[9]. The city's image brand design, first of all, needs to be from the city's cultural and spiritual basis for the overall shaping of its image [10]. The logo of a city is not only a symbol representing the city, but also a recognizable symbol distinguishing it from other cities [11], [12]. Whether the design of the whole set of city image extended by it is accurate or not determines whether the city can show its own characteristics and future development prospects [13], [14]. Therefore, the positioning of the city brand is the most important part of the construction of the city image brand, and the design of the city brand image is the embodiment of the city brand positioning, which not only highlights the value of the city, but also shapes the unique brand charm of the city through mass communication [15]-[17].

This paper constructs the evaluation index system of brand competitiveness influencing factors of city image IP, and calculates the weight value of each index. The TOPSIS method is introduced to construct the decision matrix of the preferred indicators of the alternatives, and the distance between the alternatives and the positive and negative ideal solutions is calculated by combining the weights of the indicators. The limitations of TOPSIS method are further optimized using grey correlation analysis to calculate the grey correlation between indicators, determine the optimal designer, and comprehensively assess the optimization effect of the scheme. The optimization of urban image IP design in specific provinces and cities is taken as an example to verify the application value of the proposed method.

II. Technical support related to IP design of urban image based on gray correlation analysis

This chapter constructs the evaluation index system of factors influencing the competitiveness of tourism city image IP brand, and applies the method of approximating the ideal solution ranking and gray correlation analysis to find the optimal design scheme and improve the effect of tourism city brand communication.

II. A. Construction of evaluation index system for factors affecting brand competitiveness of tourism cities

II. A. 1) Principles for the construction of evaluation indicators

1) Principle of completeness. Since the influencing factors of IP brand competitiveness of tourist cities involve several aspects, the selection of indicators must be comprehensive in order to provide complete feedback on the status of the evaluation object.

2) Principle of feasibility. The principle of feasibility requires that the selection of evaluation indicators must take into account the possibility and difficulty of data collection.

II. A. 2) Construction of evaluation indicators

Based on the tourists' perspective, guided by the principle of evaluating index construction, and combined with literature review and expert interviews, this paper finally establishes the evaluation index system of influencing factors of tourism city brand, which consists of 4 first-level indexes, 7 second-level indexes and 20 third-level indexes. Table 1 shows the specific evaluation indexes of the influence factors of IP brand competitiveness of tourist cities.

Table 1: Evaluation indicators for the competitiveness of urban IP brands

Influencing factors		Three-level evaluation index
First-level evaluation index	Secondary evaluation index	
Core factor (A1)	Tourism resources (B1)	Popularity of tourism resources(C1)
		Degree of attractiveness of tourism resources(C2)
		Protection status of tourism resources(C3)
	Tourism products (B2)	Characteristics of tourism products(C4)
		Tourism product quality(C5)
		Tourism product prices(C6)
Environmental factor (A2)	Urban environment (B3)	Urban climate comfort(C7)
		Urban environmental quality(C8)
		Friendliness of urban residents(C9)
Supportive factor (A3)	Infrastructure (B4)	Convenience of urban transportation(C10)
		Accommodation conditions(C11)
		Catering conditions(C12)
	Tourism service (B5)	Service quality of practitioners(C13)
		Tourism after-sales service(C14)
		Tourist feedback and complaint mechanism(C15)
	Tourist destination safety (B6)	War and criminal incidents(C16)
		Urban public security situation(C17)
		Risk of urban natural disasters(C18)
Brand factor (A4)	Brand communication (B7)	Popularity of tourist destinations(C19)
		Reputation of the tourist destination(C20)

1) Core factors. Including 2 secondary indicators of tourism resources and tourism products. Among them, tourism resources are evaluated by 3 tertiary indicators of tourism resources' popularity and viewability, and the protection status of tourism resources; tourism products include 3 tertiary indicators of tourism products' characteristics, quality and price.

2) Environmental factors. Only 1 secondary indicator of urban environment is included. Urban environment is evaluated by 3 tertiary indicators of urban climate comfort, urban environmental quality, and urban resident friendliness.

3) Supportive factors. Includes 3 secondary indicators of infrastructure, tourism services and safety of tourist places. Among them, the infrastructure is evaluated by 3 level 3 indicators of the accessibility of intra-city transportation, accommodation and catering conditions; tourism services include 3 level 3 indicators of the service quality of practitioners, tourism after-sales service and tourists' feedback and complaint mechanism; and the safety

of the tourist place includes 3 indicators of the war and crime incidents, the security situation of the city and the risk of natural disasters in the city.

4) Branding factors. Only 1 secondary indicator of brand communication is included. Brand communication includes 2 tertiary indicators, namely, the popularity of the destination and the reputation of the destination.

II. B.Toward an Ideal Solution Sorting (TOPSIS) Method

The TOPSIS method is also commonly referred to as the ideal point approximation method. This method is used to prefer alternatives based on a comprehensive analysis of how close the alternatives are to the positive ideal and how far away they are from the negative ideal by calculating the distance between the alternatives and the positive and negative ideal. When the relative proximity of the alternatives is greater, it means the corresponding program is better, and vice versa, it means the program is worse. For the computational application of the TOPSIS method in the optimization of urban image IP design solutions, the specific steps are shown below:

1) Establish the initial decision matrix

Assuming that there is m alternative, the corresponding alternative's preference indicators are all n, construct the initial matrix:

$$U_{m\times n}=\begin{bmatrix} u_{11} & u_{12} & \cdots & u_{1n} \\ u_{21} & u_{22} & \cdots & u_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ u_{m1} & u_{m2} & \cdots & u_{mn} \end{bmatrix} \tag{1}$$

2) Normalization of the initial decision matrix

Because the preferred indicators selected earlier are divided into benefit-type indicators and cost-type indicators, it is necessary to normalize matrix U according to the following formula to construct a standardized matrix V .

$$v_{ij}=\frac{u_{ij}-\min u_j}{\max u_j-\min u_j},\ j\in A_1 \tag{2}$$

$$v_{ij}=\frac{\max u_j-u_{ij}}{\max u_j-\min u_j},\ j\in A_2 \tag{3}$$

where $\max u_j$ and $\min u_j$ represent the maximum and minimum values of the j indicator, respectively; A_1 and A_2 represent the benefit and cost indicators, respectively.

The normalization matrix is calculated as V :

$$V_{m\times n}=\begin{bmatrix} v_{11} & v_{12} & \cdots & v_{1n} \\ v_{21} & v_{22} & \cdots & v_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ v_{m1} & v_{m2} & \cdots & v_{mn} \end{bmatrix} \tag{4}$$

3) Construct the weighting matrix

Introduce the weight ω of the preferred indicator and multiply it with the standard matrix after normalization process to get the weighting matrix:

$$Q_{m\times n}=V_{m\times n}\cdot\omega_{m\times n}=\begin{bmatrix} v_{11}\omega_1 & v_{12}\omega_2 & \cdots & v_{1n}\omega_n \\ v_{21}\omega_1 & v_{22}\omega_2 & \cdots & v_{2n}\omega_n \\ \vdots & \vdots & \ddots & \vdots \\ v_{m1}\omega_1 & v_{m2}\omega_2 & \cdots & v_{mn}\omega_n \end{bmatrix} \tag{5}$$

where $\omega=\begin{bmatrix} \omega_1 & & & \\ & \omega_2 & & \\ & & \ddots & \\ & & & \omega_n \end{bmatrix}$.

4) Selection of positive and negative ideal programs

$$S_j^+ = \max_i q_{ij}, i = 1, 2, \cdots, m \tag{6}$$

$$S_j^- = \min_i q_{ij}, i = 1, 2, \cdots, m \tag{7}$$

where $\max q_{ij}$ and $\min q_{ij}$ represent the maximum and minimum values corresponding to the j rd preferred indicator, respectively.

5) Calculate the distance between the alternative and the positive and negative ideal programs

The Euclidean distance is used here for calculation:

$$d_i^+ = \sqrt{\sum_{j=1}^{n} (S_j^+ - q_{ij})^2}, i = 1, 2, \cdots, m \tag{8}$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} (S_j^- - q_{ij})^2}, i = 1, 2, \cdots, m \tag{9}$$

6) Calculate the relative closeness of the alternatives

$$\theta_i = \frac{d_i^-}{d_i^- + d_i^+}, i = 1, 2, \cdots, m \tag{10}$$

The concept of TOPSIS method is clear, operable, and less disturbed by subjective factors in decision-making, and the obtained optimal results usually have better reliability. However, the method still has shortcomings in special circumstances, such as the alternatives and the positive and negative ideal programs close to or equal to the distance, can not rely on the method alone to obtain an accurate optimal program, often need to combine with gray correlation analysis to make up for its own shortcomings.

II. C.Evaluation model based on gray correlation

II. C. 1) Gray correlation analysis

Gray system theory is a mathematical method used to solve systems with incomplete information. As a method for solving system problems in information-poor situations, gray system theory has been widely used in decision analysis and system modeling in many fields such as natural science, social economy and so on since its inception. As an important part of gray system theory, gray correlation analysis is able to solve complex problems without sufficient data information because it does not require a high amount of sample data and the calculation process is clear, especially for complex problems, based on the principle of gray system, the gray correlation is used as an evaluation criterion, and the construction of multi-objective gray correlation decision-making model for analysis and research has been more mature.

The basic principle of gray correlation analysis is to determine the comparison sequence and reference sequence by examining the differences and correlations between the elements in the system, comparing the comparison sequence with the reference sequence curve, analyzing the geometric similarity between the comparison curves, and judging the degree of close fit between them, and using the value of the correlation as a quantitative indicator, if the value of the correlation is larger, it indicates that the geometric similarity between the two curves is higher. If the correlation value is larger, it indicates that the geometric similarity of the two curves is higher, and the change trend of the comparison series is closer to the reference series. By comparing the size of the correlation value of each evaluation object to judge the goodness of the evaluation object, the larger the correlation value, the better the evaluation object is than the other evaluated objects.

II. C. 2) Calculation steps of gray correlation analysis

(1) Collect raw data of indicators and determine the comparison sequence and reference sequence. Assume that there are m evaluation object (target) and n evaluation indicators. The m evaluation objects correspond to m comparison sequences: $X_i = \{x_{i1}, x_{i2}, \cdots, x_{ij}, \cdots, x_{in}\} (i = 1, 2, \cdots, m)$, where x_{ij} represents the value of the j th indicator data corresponding to the i th evaluation object. The optimal value of each indicator is selected from the evaluation indicator data to form the reference sequence X_0, in which the forward indicator takes the maximum value and the reverse indicator takes the minimum value, and the reference sequence X_0 can be expressed as: $X_0 = \{x_{01}, x_{02}, \cdots, x_{0j}, \cdots, x_{0n}\}$.

(2) Evaluation indicators are processed without quantification. Due to the differences in the outline and order of magnitude of each indicator, the scale of comparison is different, and if used directly, the accuracy and reliability of

the evaluation results cannot be guaranteed. Therefore, in order to make the indicators comparable, it is necessary to process the raw data of the indicators. The common methods of dimensionless quantization include initial value method, mean value method, interval value method, etc. In this paper, the interval value method is proposed to be used. Because of the different evaluation criteria for each indicator, the indicators are divided into two categories: forward indicators and reverse indicators. The raw data of forward and reverse indicators are standardized according to equations (11) and (12), respectively.

$$x_{ij}^{*}=\frac{x_{ij}-\min x_{ij}}{\max x_{ij}-\min x_{ij}} \tag{11}$$

$$x_{ij}^{*}=\frac{\max x_{ij}-x_{ij}}{\max x_{ij}-\min x_{ij}} \tag{12}$$

where, x_{ij} is the value of the j rd evaluation object under the i nd evaluation index $(i=1,2,\cdots,n; j=1,2,\cdots,m)$. After standardization, x_{ij}^{*} satisfies $0\le x_{ij}^{*}\le 1$ and does not change the relative variability of the original data.

3) Calculate the gray correlation coefficient. The size of the correlation coefficient determines the degree of correlation between the two series on the i th indicator. The formula for calculating the correlation coefficient is:

$$\beta_j(i)=\frac{\min\{\Delta_i(j)\}+\rho\max\{\Delta_i(j)\}}{\Delta_i(j)+\rho\max\{\Delta_i(j)\}} \tag{13}$$

$$\Delta_i(j)=\left|X_0^{*}(j)-X_i^{*}(j)\right| \tag{14}$$

where $\beta_j(i)$ is the correlation coefficient between the j rd index of the i nd evaluation object and the corresponding optimal index $(i=1,2,\cdots,m; j=1,2,\cdots,n)$; ρ is the discrimination coefficient, usually taken as $\rho=0.55$; $\Delta_i(j)$ is the absolute difference between the reference sequence and the comparison sequence on the j th evaluation index after the dimensionless processing.

4) Calculate the gray correlation degree. The formula for calculating the gray correlation degree is:

$$r_i=\sum\nolimits_{j=1}^{n}\beta_j(i)w(j) \tag{15}$$

where r_i is the gray-weighted correlation $(i=1,2,\cdots,m)$ of the i nd evaluation object, and $w(j)$ is the weight corresponding to the j th evaluation indicator.

II. C. 3) Gray correlation evaluation model

Based on hierarchical analysis-entropy weight method and gray correlation theory, the gray correlation evaluation matrix model of neighborhood comparison is established:

$$R=W\bullet B \tag{16}$$

where: $R=[r_1,r_2\ldots\ldots,r_m]$;

$W=[w(1),w(2)\ldots\ldots,w(n)]$;

$$B=\begin{pmatrix}\beta_1(1) & \beta_1(2) & \beta_1(m)\\ \beta_2(1) & \beta_2(2) & \beta_2(m)\\ \beta_n(1) & \beta_n(2) & \beta_n(m)\end{pmatrix}.$$

The correlation values r1, r2,...,rm are arranged in order from smallest to largest, where the evaluation object with the largest gray correlation is the optimal target.

III. Grey correlation analysis based on the optimization of city image IP and analysis of communication effect

The Approximate Ideal Solution Ranking Method and Gray Correlation Analysis are applied to optimize the IP design of each city's image in Province S and analyze its final brand communication effect.

III. A. Indicator processing based on TOPSIS methodology

III. A. 1) Statistics on relevant indicators

In order to evaluate the brand competitiveness of IPs in prefecture-level tourism cities within Province S, data related to 20 indicators affecting the competitiveness of IP brands in 10 cities in Province S from 2021 to 2023 were obtained. Table 2 summarizes and presents the relevant indicator data (partially). In the data related to the first 8 indicators, it can be seen that the popularity of the tourism resources of the IPs of the 10 cities is divided into 3, 4, and 5 grades according to the grades, and the higher the grade of the tourism city IP, the better the degree of viewability of the related tourism resources, the state of protection, the characteristics/quality/price of the products, the climate comfort, and the quality of the environment. There is a positive correlation between tourism city IP popularity and related resources.

Table 2: IP Brand Competitiveness Index Data (Top 8 Items)

Item / City	C1/ (level)	C2/ (%)	C3/ (%)	C4/ (%)	C5/ (%)	C6/ (10*3 yuan)	C7/ (%)	C8/ (%)
1	4	80	75	65	72	1.2	85	86
2	5	91	90	90	91	1.6	90	91
3	3	74	70	72	71	0.9	73	75
4	5	90	83	85	84	2.3	82	83
5	4	82	80	80	81	1.5	84	82
6	3	70	71	70	72	1.0	70	71
7	3	71	70	70	80	1.1	71	70
8	5	90	89	85	80	1.3	86	80
9	5	92	90	92	91	2.1	95	93
10	4	83	80	81	82	1.5	80	80

Table 3: Weights of indicators at all levels

First-level indicator	Weight	Secondary indicators	Weight	Third-level indicators	Weight
A1	0.35	B1	0.20	C1	0.10
				C2	0.05
				C3	0.05
		B2	0.15	C4	0.06
				C5	0.04
				C6	0.05
A2	0.20	B3	0.20	C7	0.06
				C8	0.06
				C9	0.08
A3	0.30	B4	0.12	C10	0.05
				C11	0.04
				C12	0.03
		B5	0.10	C13	0.04
				C14	0.03
				C15	0.03
		B6	0.08	C16	0.02
				C17	0.03
				C18	0.03
A4	0.15	B7	0.15	C19	0.06
				C20	0.09

III. A. 2) Calculation of indicator weights

The weights of the evaluation indicators of IP brand competitiveness of tourism cities in Province S are calculated, and Table 3 shows the weights of the specific indicators obtained.Among the evaluation indicators of the factors affecting the competitiveness of the IP brand of tourism cities in Province S, the first-level indicator with the largest weight is the core factor, which reaches 0.35; the second-level indicators with the largest weight are tourism resources and urban environment, which both have a weight of 0.20; and the first three tertiary indicators with the largest weights are The popularity of tourism resources (C1), the reputation of tourist places (C20), and the friendliness of urban residents (C9), with weights of 0.10, 0.09, and 0.08 respectively.It can be preliminarily analyzed that, if a tourist city wants to enhance the competitiveness of its own IP brand, it must have tourism resources that are well known to the public and the urban environment of the place is generally recognized.

III. A. 3) TOPSIS assessment results

Based on the calculated weights of the assessment indicators, a weighted standardized matrix for IP optimization of tourism city image in S province is constructed, and the optimization effect of different schemes is evaluated using the TOPSIS method. Table 4 shows the assessment results of TOPSIS method. Figure 1 shows the trend of TOPSIS assessment results. The larger the comprehensive assessment index D_i is, the better the brand communication optimization effect of tourism city image IP is. Comprehensive analysis of the assessment results and change trends in Table 4 and Figure 1 shows that, with the continuous optimization and upgrading of the program, the IP image of Province S is generally on a gradual upward trend, with the comprehensive assessment index D_i fluctuating from 0.314247 to 0.921435, and the brand competitiveness is constantly increasing. From this, it can be deduced that Province S can significantly improve the competitiveness of tourism brands in various cities by designing a targeted tourism image IP optimization scheme based on the results of the calculation of indicator weights.

Table 4: Evaluation results by the TOPSIS method

Plan	Positive ideal solution Euclidean distance	Negative ideal solution Euclidean distance	Comprehensive Evaluation Index
1	0.454499	0.208268	0.314247
2	0.519130	0.125852	0.195123
3	0.484222	0.232861	0.324731
4	0.382774	0.247130	0.392322
5	0.354926	0.352284	0.498130
6	0.381491	0.335213	0.467711
7	0.147680	0.490091	0.768434
8	0.050342	0.590450	0.921435

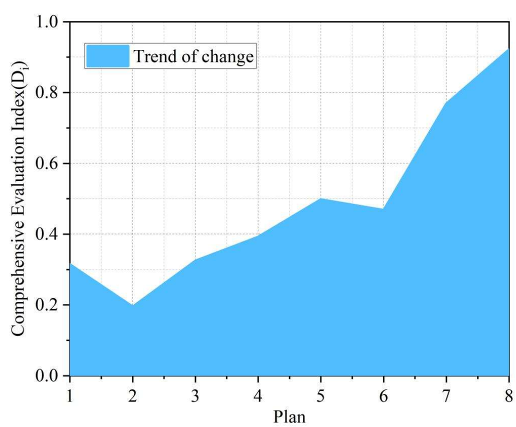

Figure 1: Change trend of TOPSIS assessment results

III. B. Indicator analysis based on the gray correlation method

III. B. 1) Evaluation analysis of the first tier of indicators

In order to gain a deeper understanding of the optimization level of the brand communication effect of each program's urban image IP design during the implementation process, this paper calculates the relative closeness of the grey correlation of the four first-level indicators in Province S from 2021 to 2023. Table 5 shows the calculation results. In the process of designing the city image IP to improve brand communication effect in 3 years, although the gray correlation relative closeness of each indicator at the level 1 indicator level fluctuates, it always stays at a level greater than 0.500. Especially, the relative closeness of the gray correlation of the brand factor (A4) indicator is always greater than 0.550 in 3 years, which indicates that in the process of improving the IP of city image by using the gray correlation analysis method, the relevant departments pay special attention to improving the popularity and reputation of the tourist city, and combine with the protection of the city's resources and the improvement of the infrastructure, so as to improve the competitiveness of the city brand in an all-round way.

Table 5: Relative closeness degree of the secondary indicator layer

Secondary indicators	Relative closeness degree of grey correlation		
	2021	2022	2023
A1	0.537	0.510	0.548
A2	0.554	0.503	0.516
A3	0.525	0.595	0.515
A4	0.571	0.561	0.568

III. B. 2) Evaluation results and analysis

Table 6 shows the evaluation results of brand competitiveness of tourism cities in S province. Table 7 provides descriptive statistics of the analysis results.Among the 4 level 1 index factors, the image IP of city 1 all has the strongest brand communication effect, which reaches 4.8150, 1.9410, 4.8616, 4.8127 respectively, and the gap with the other cities is very large. Therefore, the remaining cities can refer to the design scheme of City 1 to improve the brand communication effect when creating city image IP. Meanwhile, among the four first-level indicator factors, the branding factor has the smallest standard deviation value of 0.58, and the standard deviation values of the remaining three factors are all 1, indicating that the branding factor has a relatively small difference among the 10 tourism city IP optimization in S province. The reason may be that even though there are differences in the tourism resources of each city, they all focus on the brand communication effect of IP.

Table 6: Results and ranking of Element Brand competitiveness

Rank	City	Core factor	City	Environmental factors	City	Supportive factors	City	Brand factor
1	1	4.8150	1	1.9410	1	4.8616	1	4.8127
2	2	0.7845	2	0.3161	3	0.9938	5	0.6378
3	3	0.6399	3	0.2578	2	0.9869	4	0.5587
4	4	0.6115	4	0.2466	4	0.6168	3	0.5142
5	5	0.5131	5	0.2065	6	0.5441	6	0.5088
6	6	0.4988	6	0.2012	10	0.5236	10	0.4309
7	7	0.4844	7	0.1954	7	0.4755	7	0.3497
8	8	0.4453	8	0.1795	8	0.4609	2	0.3065
9	9	0.4357	9	0.1758	5	0.4477	9	0.2836
10	10	0.3786	10	0.1529	9	0.4362	9	0.2653

Table 7: The analysis results describe the statistical values

	Core factor	Environmental factors	Supportive factors	Brand factor
Average	0.540	0.610	0.440	0.220
Standard error	0.067	0.067	0.046	0.022
Median	0.484	0.524	0.431	0.201
Standard deviation	1	1	1	0.58
Kurtosis	-1.350	-0.577	-1.092	-1.328
Skewness	-0.576	0.090	-0.321	-0.641
Minimum value	0.379	0.153	0.436	0.265
Maximum value	4.815	1.941	4.862	4.813
Sample size	10	10	10	10

IV. Conclusion

This paper integrates the TOPSIS method and gray correlation analysis to select the optimal city image IP design scheme and analyze its impact on the city brand communication effect. The most weighted primary indicator is core factors (0.35); the most weighted secondary indicators are tourism resources (0.20) and urban environment (0.20). The largest weights in the third-level indicators are the popularity of tourism resources (0.10), the reputation of tourist places (0.09), and the friendliness of urban residents (0.08).The comprehensive assessment index D_i of the eight programs fluctuates from 0.314247 to 0.921435, and the effect of brand communication is constantly increasing. The gray correlation of the four first-level indicators is greater than 0.500, with the branding factor being greater than The gray correlation of the four level indicators is greater than 0.500, in which the brand factor is greater than 0.550, and the standard deviation value is the smallest, only 0.58. The method proposed in this paper can calculate the weight of each indicator, so as to better search for the optimal urban image design program and create brand communication power. In the future, deep learning algorithms can be introduced to process the data of each index to improve the accuracy of the data and provide more standardized data for subsequent program selection.

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