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Article

Research on Brand Influence Assessment Model of Tourism Souvenirs in Social Media Data Analysis Environment

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Abstract: This study is based on the insight of the current situation of the development of tourism souvenirs in the practice of enterprises, and is carried out in response to the reality of the pain point of the cooperative project about the lack of scientific basis for the ranking of tourism souvenir brands. The fuzzy Delphi method is used to screen the indicators for assessing the brand influence of tourism souvenirs, and the weights of the indicators are determined based on the network hierarchy analysis method to realize the construction of the assessment model for assessing the brand influence of tourism souvenirs, and apply it to the actual assessment work. This paper finally constructs a brand influence assessment system containing 6 dimensions and 16 indicators. The weights of brand satisfaction and brand satisfaction in the first-level indicator factors rank top, with the weights of 0.2253 and 0.1835 respectively, which verifies the key role of customer satisfaction and brand awareness in shaping the brand influence of tourism souvenirs. Using the model to rank 50 tourism souvenir brands, the results obtained overlap with the ranking of authoritative websites by as much as 80%, which verifies the validity of the model. This paper fills the theoretical gap in the field of tourism souvenir brand evaluation and provides a tool reference for the development of tourism souvenir brands.

Keywords: brand influence evaluation; tourism souvenirs; social media; fuzzy Delphi method; network hierarchy analysis method

1. Introduction

With the popularity of tourism culture and the rise of the national economy in recent years, travelers of all ages are seeking a different travel experience, indicating that the tourism market has a large space for improvement [1-2]. Nowadays, people gradually shift from satisfying physiological needs to spiritual enjoyment, tourism demand increases, tourism souvenirs by the official attention will enhance the economic value of tourism itself, but also increase jobs, enhance local visibility and related brand linkage development, shaping the local image, protecting local cultural heritage, and promoting the development of the national economy, with the increase in the development potential of the tourism souvenir market, tourism souvenirs innovation and the ability to attract consumers gradually improved [3-7].

Tourism souvenirs have experienced an extension from natural commodities (local specialties, etc.) to handmade commodities (embroidery, etc.) and then to industrialized commodities (keychains, etc.) [8-9]. Currently, each tourist souvenir gradually recognizes its own brand positioning from the chaotic development and production relations, and the brand manager's ability is gradually maturing, which promotes the sales of souvenirs and the profits of local tourist souvenirs are steadily increasing [10-13]. For example, the “Forbidden City Taobao” in the identification of their own brand positioning, to take effective strategies to make the production and management of profits further increase. The customers of “Forbidden City Taobao” are more prominent in the 25-35 years old group, which likes fresh and popular Internet trend products. In 2015, the customized cell phone holder on the shelves of the 90th anniversary of the National Palace celebrations was sold out of 1500 cell phone holders in just one hour [14-15].

At present, although the market has a homogenization trend, the global sales scale of tourism

souvenirs has reached a record high in 2025, but the development of productivity, especially the technological revolution, has expanded the production mode and value innovation of tourism souvenirs, which makes the tourism souvenir market sustainable [16-19]. Based on this, tourism souvenir brands need to innovate and develop in the homogenized price war, deeply integrate local cultural heritage and commodities, create a special tourism souvenir brand, improve the industrial chain from design to sale by combining blockchain, Internet of Things and other emerging technologies, and improve the quality of consumer services, which is a problem that tourism souvenir brands need to solve nowadays [20-22].

In today's digital era, social media has become an indispensable part of people's lives. It has not only changed the way we communicate, but also had a profound impact on the decision-making process of consumers, and social media plays a role in every aspect, from purchasing daily necessities to choosing major investments [23-24]. Through social platforms such as Jitterbug, Xiaohongshu, Twitter, and Facebook, it has reconfigured consumer consumption scenarios and provided more sharing channels for travel and tourism souvenirs, allowing users to learn about the culture of a certain place and purchase related tourism souvenirs without leaving their homes [25-28]. This change in marketing reminds tourism souvenir brands of the need to build a dynamic brand impact assessment system, understand the changes in consumer demand, and combine the souvenir qualities to complete brand innovation and development to improve brand impact.

In the field of brand management, applied research on social media data has shifted from simple text mining to multimodal brand data analysis. Aggrawal et al. (2017) proposed a framework for analyzing brand popularity on social media, i.e., website network construction framework, content crawling framework, and webpage ranking assignment framework, and combined with social user based on text edge analysis and sentiment analysis data, the brand popularity can be effectively obtained [29]. Nawaz et al. (2018) analyzed the reputation of six restaurant brands on Twitter, using a sentiment dictionary to analyze the relevant English tweet terms, make negative or positive distinctions, and score the reputation under a beta probability function [30]. Kusumasondjaja (2018) analyzed the reputation of six restaurant brands on social media by analyzing the different social media brand-related posts, it was concluded that brand marketing on Twitter, Facebook, and Instagram tended to be informative, entertaining, and mixed informational+entertainment, respectively, and that different platforms gained different brand communication effects [31]. Pringle and Fritz (2019) analyzed the text of content posted by students on Twitter and Facebook using a web analytics tool as a way to evaluate the authenticity of brands and pointed out that there is a gray area in brand-related content sharing on social media [32]. Zhang et al. (2021) analyzed the frequency of traveler's travel picture posting from social media to learn travelers' preference for souvenirs through a selective synthesis analysis method, and travelers with a high frequency of posting followed the details of souvenirs with higher supply and availability, while travelers with a low frequency of posting preferred unique souvenirs [33]. Guo and Zhu (2023) study pointed out that the consistency of non-heritage souvenirs or inheritors and souvenir authenticity affect tourists' willingness to purchase souvenirs [34], Tanaka et al. (2024) showed that brand authenticity affects souvenir brand reputation under the company's rooted commitment to the brand [35], so brand authenticity will be used as a metric for souvenir brand evaluation,. Especially with social media marketing, the gray area of false brand information is difficult to avoid. While Alnazzawi et al. (2022) constructed a corpus of fake advertisements with clear themes and fine labeling, through which false news and information related to product impact on social media can be detected [36]. Marwat et al. (2022) can effectively identify false evaluation information by performing sentiment analysis on user product evaluation information in social media to assist in brand impact assessment [37].

In addition, Xu et al. (2021) analyzed unstructured text data of brands in social media using analytical techniques such as word cloud, clustering and word association analysis to understand the core positioning of the brand as well as changes in customers' attitudes [38]. Bilovodska and Kulik (2020) pointed out that opinion leaders in social media are an important marketing tool for most brands to promote their goods [39], and Chavadi et al. (2023) analyzed that brand communities in social media are also a marketing tool to bring brands closer to consumers, and communities help to increase brand trust, and these two marketing data are important for assessing the impact of brands [40]. Carlson et al. (2021) used stimulus-subject-response theory to assess the impact of online brand communities in different countries impact on millennial customers, with community website quality mediating customer loyalty to a brand under enhanced customer interaction [41]. Zhang and Moe (2021) addressed the method of assessing brand popularity based on social media data by constructing a probabilistic graphical model-supported collective inference architecture and a Markov Chain Monte Carlo sampling technique, and constructed an assessment model that removes these social media data errors, making the evaluation structure more accurate [42]. Alla et al. (2025) proposed an analytical model for evaluating customer engagement in social media, which covers factors such as customer interaction, satisfaction, and social influence in the evaluation system, and this analytical model provides a reference for brand influence

assessment [43].

This study first introduces the connotation of brand influence and common index system, analyzes the important role of social media data in assessing brand influence, and lays the foundation for introducing social media data analysis for brand influence assessment of tourism souvenirs. Then, combining the fuzzy Delphi method and network hierarchical analysis method, a brand influence assessment model for tourism souvenirs was constructed, and 50 tourism souvenir brands were selected for the application of the model, and the resulting rankings were compared with the actual rankings to test the practicality of the constructed model.

2. Analysis of the effect of social media on brand influence

This chapter firstly elaborates on the connotation of brand influence and the conventional index system, and analyzes the effect of social media big data on brand influence, laying the foundation for realizing the effective evaluation of brand influence on tourism souvenirs based on social media data analysis.

2.1. Brand influence and its evaluation index system

The so-called brand influence refers to the brand's ability to develop the market, occupy the market and then obtain profits. Nowadays, brand influence has become an important factor affecting customers' choice of goods, and brand influence is a comprehensive reflection of core influence and extended influence, which is the enhancement of extended influence at a higher level and the most centralized manifestation of innovation and brand power as the basis and source. With the gradual formation of brand selection tendency and the gradual concentration of communication resources to the strong brand media, the implementation of brand strategy to create brand influence is becoming a key point of victory.

Brand influence includes seven evaluation indexes: brand awareness, brand recognition, brand reputation, brand preference, brand share, brand satisfaction and brand loyalty, which come from consumers' direct evaluation and recognition of the brand. Among them, brand loyalty is the core indicator. Because brand loyalty determines the customer's choice of brand preference, more importantly, brand loyalty determines the degree of attention, which will trigger the active exploration or understanding of the relevant background.

The brand influence index system is mostly extended and expanded around the above seven indexes with tendency and focus, resulting in a number of indexes that evaluate the characteristics of various aspects of the target and their interconnections, and then constitutes an organic whole with an inherent structure. Systematic searching of online media and newspaper media according to specific frequency, broadening of audience feedback channels or direct application of brand influence measurement formulae are all ways of evaluating brand influence by applying the brand influence index system.

2.2. The Impact of Social Media Big Data on Brand Influence

2.2.1. Enhancing Brand Recognition

(1) Expand the scope of brand dissemination. Social media platforms have a huge user base, tourism souvenir brands through the release of attractive content on social media, such as beautiful souvenir pictures, unique travel environment display, interesting travel stories, etc., to quickly attract a large number of users' attention. After browsing to these contents, if users feel interested, they will like, comment and forward, so that the brand information spreads rapidly in the user's social circle.

(2) Increase brand exposure. The algorithmic recommendation mechanism of the social media platform can push the relevant tourism souvenir brand content to potential users according to their interests, behavioral habits and other factors. Tourism souvenir brands optimize the content publishing strategy, high content quality and relevance, and increase exposure opportunities on social media platforms.

2.2.2. Branding

(1) Demonstrate brand characteristics and personality. Tourism souvenir brands use social media platforms to display their unique features and personality charm, publishing content about the history and culture of tourism souvenirs, brand concepts, stories behind the special souvenirs, etc., so that consumers can better understand the connotation and value of the brand. For example, tourist areas can share local tourism culture and traditional craft skills through social media, highlighting the regional characteristics of souvenirs and shaping a unique brand image.

(2) Guide consumer cognition and emotional resonance. User comments and word-of-mouth on

social media have an important impact on the shaping of brand image of tourism souvenirs, and consumers often refer to other users' comments on social media when choosing tourism souvenirs.

2.2.3. Enhancing consumer interaction

(1) Establish direct communication channels. Social media for tourism souvenir brands and consumers to establish a direct communication channel between the tourism souvenir brand with the help of social media platforms to release the latest souvenir information, preferential activities, tourism district dynamics and other content in a timely manner, so that consumers understand the brand's latest situation in the first time. At the same time, consumers can also combine comments, private messages and other ways to travel souvenir brand feedback and suggestions, put forward their own needs and expectations.

(2) Carry out interactive marketing activities. Tourism souvenir brands use social media platforms to carry out a variety of interactive marketing activities, such as online lucky draws, punch card challenges, and the most popular souvenir selection, to attract consumer participation.

3. Tourism Souvenir Brand Influence Assessment Model Construction

This chapter introduces the construction process of the brand influence assessment model of tourism souvenirs, firstly, through the fuzzy Delphi method of indicator screening, the construction of the assessment indicator system, and then based on the network hierarchical analysis method to determine the weight of the indicators, to realize the construction of the brand influence assessment model.

3.1. Fuzzy Delphi method

Fuzzy Delphi method [44] is the introduction of fuzzy theory in the general Delphi method, the use of fuzzy triangular number method to integrate the expert opinion, and gray correlation to determine whether the expert opinion reaches convergence, the opinion convergence before calculating the expert opinion leveling, whether it is rigorous and reasonable. Then the expert for each assessment project, delineate the existence of possible interval values. The smallest of these values is the Conservative estimate of the expert's quantitative score for the evaluation index, while the maximum value of the interval is the Optimistic assessment of the expert's quantitative score for the evaluation item. Analyze and evaluate each evaluation item of Conservative estimate and Optimistic assessment given by all experts. Remove the extreme values that are more than twice the standard deviation value, and at the same time, remove the minimum value of C_L^i in Conservative estimate that has not been removed. The geometric mean is C_M^i , the maximum value is C_U^i, and the minimum value O_L^i, the average value is O_M^i , and the maximum value is O_U^i of Optimistic assess-ment. From this, the fuzzy trigonometric numbers of Conservative estimate and Optimistic assessment for each evaluation index i can be established respectively:

$$C^i = \left(C_L^i, C_M^i, C_U^i\right), O^i = \left(O_L^i, O_M^i, O_U^i\right) \tag{1}$$

(1) No gray fuzzy space situation: if $C_U^i \le O_M^i$, it means that there is no fuzzy triangular number of overlapping intersections, that is to say, there is a consensus of the experts among the intervals. From the evaluation item i, it can be seen that the Conservative estimate of the experts has reached a consensus. Similarly, the Optimistic assessment of all experts has reached consensus. Therefore, the basic model is:

$$G^i = \left(O_M^i + C_M^i\right) / 2 \tag{2}$$

(2) There is a gray fuzzy space situation, but the expert disagreement is small: if $C_U^i > O_L^i$, it means that the fuzzy triangular numbers have overlapping phenomenon, and when the gray fuzzy space $Z^i = C_U^i - O_L^i$, which is smaller than the expert's Conservative esti-mate for the assessment item with the average value of Optimistic assessment $M^i = O_M^i - C_M^i$, which indicates that in the presence of tiny gray fuzzy space, the difference between the experts who give extreme opinions and other experts and scholars will not be too big, so it does not lead to the divergence of opinions to disperse. Therefore, let the value of consensus importance of item i G^i be equal to the two values of fuzzy triangular number

gray fuzzy space, and by solving MIN and thus the fuzzy set $F^i\left(X_j\right)$, the calculation model is as follows:

$$F^i\left(X_j\right)=\left\{\int_x\left\{\min\left[C^i\left(x_j\right),O^i\left(x_j\right)\right]\right\}\mathrm{d}x\right\}$$
$$G^i=\left\{x_j\mid\max\mu_{F^i}\left(x_j\right)\right\} \tag{3}$$

(3) There is a gray fuzzy space situation, but the experts are more divergent: if $C_U^i<O_L^i$, it means that the fuzzy triangular numbers have overlapping phenomenon, and when $Z^i=C_U^i-O_L^i$ is greater than $M^i=O_M^i-C_M^i$, it means that Within the opinion interval of the experts and scholars, a fuzzy region without consensus is generated, that is to say, some experts have put forward extreme opinions that are very different from others, and the opinions are different, thus generating a fuzzy region. Therefore, it is necessary to provide these evaluations that have not reached convergence to the experts for reference, and repeat the above work, continue to do the questionnaire, and so on until the consensus is reached, and ultimately the importance of the expert consensus can be obtained as the value of G^i for the termination.

Therefore, the above calculated expert consensus value G^i, the higher the value, the higher the degree of expert consensus.

3.2. Network Hierarchy Analysis

Network Hierarchy Analysis (ANP) [45] is an extension of the Hierarchy Analysis Method (AHP). Considering the interrelatedness and mutual influence between the indicators in this evaluation system, this paper adopts the Network Hierarchy Analysis (ANP) to quantitatively study the evaluation model of tourism souvenir brand influence and further determine the weights of each evaluation indicator. This method takes into full consideration the feedback and interaction between indicators during the research process, and can accurately reflect the dependence between internal elements and quantify the internal connection of the evaluation system, which has been applied to the evaluation research in various fields.

3.2.1. Modeling Ideas for ANP Models

The structure of ANP model is shown in Fig. 1, which consists of control level and network level, reflecting the judging criteria for the realization of relevant goals and the evaluation indexes of networked structure respectively. Firstly, the control level is constructed to define the decision-making goals, and then the network level is constructed, which should be categorized to determine each element, analyze its network structure and mutual influence relationship, and establish the evaluation index system of the networked structure through investigation and analysis.

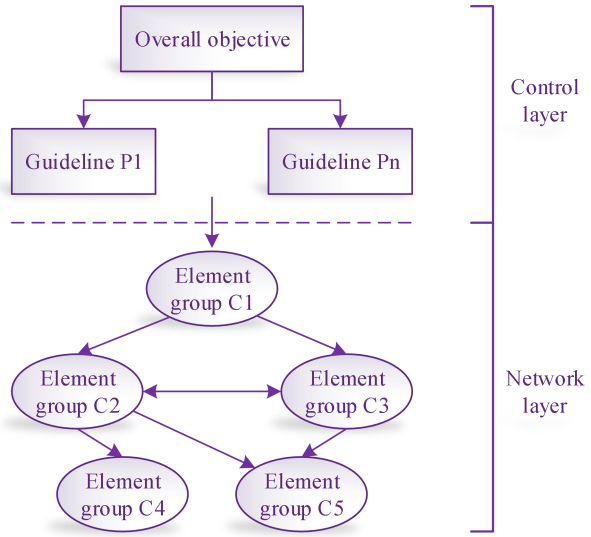

Figure 1. ANP model structure.

3.2.2. Hypermatrix creation

(1) Establish the supermatrix

After the decision objectives and decision criteria are determined, it is determined that the control layer has elements $B_1, B_2, \cdots, B_m$, the network layer has the set of elements $C_1, C_2, \cdots, C_n$, and the C_i has elements $C_{i1}, C_{i2}, \cdots, C_{in}, i = 1, 2, \cdots, n$. The elements C_p in the control layer are used as the criterion, while the elements C_j in C_{j1} are used as the sub-criteria, and then the scale comparisons with each other are performed, from which the judgment matrix is constructed to obtain the normalized eigenvectors $\left(\mathbf{w}_{i1}, \mathbf{w}_{i2}, \cdots, \mathbf{w}_{in}\right)^{\mathrm{T}}$, also known as the network element ordering vector, and the consistency test is performed on the basis of the former. After the above steps, the sorting vector relative to other elements can be obtained, and the construction of the supermatrix is denoted as:

$$\mathbf{W}_{ij} = \begin{vmatrix} \mathbf{w}_{i1}^{j1} & \mathbf{w}_{i1}^{j2} & \cdots & \mathbf{w}_{i1}^{jn_j} \\ \mathbf{w}_{i2}^{j1} & \mathbf{w}_{i2}^{j2} & \cdots & \mathbf{w}_{i2}^{jn_j} \\ \vdots & \vdots & \vdots & \vdots \\ \mathbf{w}_{in_i}^{j1} & \mathbf{w}_{in_i}^{j1} & \cdots & \mathbf{w}_{in_i}^{jn_j} \end{vmatrix} \tag{4}$$

The column vectors of the supermatrix $\mathbf{W}_{ij}$ are the elements $C_{i1}, C_{i2}, \cdots, C_{in}$ of C_{ij}, and if the elements in the group of elements C_j and C_i do not interact with each other, then the supermatrix $\mathbf{W}_{ij} = 0$, from which the supermatrix $\mathbf{W}_o$ can finally be obtained under the criterion C_p. The supermatrices of the other control layer elements can also be calculated in this way:

$$\mathbf{W}_{ij} = \begin{vmatrix} \mathbf{w}_{11} & \mathbf{w}_{12} & \cdots & \mathbf{w}_{1N} \\ \mathbf{w}_{21} & \mathbf{w}_{22} & \cdots & \mathbf{w}_{2N} \\ \vdots & \vdots & \vdots & \vdots \\ \mathbf{w}_{N1} & \mathbf{w}_{N2} & \cdots & \mathbf{w}_{NN} \end{vmatrix} \tag{5}$$

(2) Construct the weighted supermatrix

Under the control layer criterion C_p, the degree of dominance of $C_j (j = 1, 2, \cdots, n)$ elements under C_p is compared with respect to the criterion, which can lead to the normalized sorting sequence vector $\left(a_{1j}, a_{2j}, \cdots, a_{nj}\right)$. This results in a weighting matrix:

$$\mathbf{A} = \begin{vmatrix} a_{11} & \cdots & a_{n1} \\ \vdots & \vdots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{vmatrix} \tag{6}$$

where $a_{ij} \in [0,1]$ and $\sum^{n} a_{ij} = 1$.

If there is no influence between the two elements involved in the comparison, then a_{ij} is 0, and then the next step of weighted supermatrix construction can proceed:

$$\overline{W} = \overline{W}_{ij} = A \times W = \left(a_{ij} \times \overline{W}_{ij}\right) (i = 1, 2, \cdots, N; j = 1, 2, \cdots, N) \tag{7}$$

(3) Calculation of the limit supermatrix

In order to make the interdependence between the elements clearer, the work on weighted supermatrices is supplemented by the supermatrix stabilization process. Calculate the relative ordering

vector of the limit $\lim_{k\to+\infty}\left(\frac{1}{N}\right)\sum_{k=1}^{N}W^{k}$ of each supermatrix, if there exists a convergent and unique limit, then it represents the success of solving for the weighting of the evaluation indexes and the matrix The values in the corresponding rows are the weighting results.

3.2.3. Software Selection and Modeling Process of ANP

The yaanp software is an upgraded version of the yaahp software, which is a commonly used computer network hierarchical analysis method auxiliary application software, which can use network analysis method and hierarchical analysis method for decision-making activities to provide model building, computing and support big data analysis. The commonly used SD software is often not accurate enough for complex network hierarchies with more model data and is inefficient in analyzing. Therefore, under this premise, yannp software is used to analyze and calculate the ANP model.

By analyzing the relationship between the indicators, the ANP network hierarchical model for the assessment of brand influence of tourism souvenirs is constructed on this basis, and then the single network structure model of tourism souvenir brand influence factors is constructed by yannp software.

4. Research on brand influence evaluation model of tourism souvenirs

This chapter carries out the specific construction of the brand influence assessment model, and selects 50 well-developed tourism souvenir brands as empirical cases to comprehensively assess their brand influence according to the assessment model and verify the effectiveness of the constructed model.

4.1. Construction of indicator system for brand influence evaluation

4.1.1. Initial establishment of an assessment indicator framework

Based on the conventional brand influence evaluation index system, this study combines the characteristics of tourism souvenirs and the effect of social media data on brand influence, and summarizes and organizes six core brand influence of tourism souvenirs, namely, brand awareness (A_1), brand recognition (A_2), brand reputation (A_3), brand satisfaction (A_4), brand loyalty (A_5) and brand preference (A_6). Assessment dimensions. Among them, brand awareness includes 5 indicators: media attention (A_{11}), social discussion (A_{12}), brand account image (A_{13}), tourist attraction awareness (A_{14}), and brand marketing power (A_{15}). Brand awareness includes 2 indicators: product awareness (A_{21}), service awareness (A_{22}). Brand reputation includes 3 indicators: proportion of positive emotions (A_{31}), response time to bad reviews (A_{32}), and willingness to create user-generated content (UGC) (A_{33}). Brand satisfaction includes 3 indicators: Exceeded Expectations Index (A_{41}), Repurchase Interval Shortening Rate (A_{42}), and Plus Purchase Conversion Rate (A_{43}). Brand Loyalty includes 4 indicators: Repeat Purchase Intention (A_{51}), Membership Renewal Rate (A_{52}), Recommendation Degree (A_{53}), Points Redemption Activity (A_{54}). Brand preference includes 5 indicators: premium acceptance (A_{61}), design aesthetics score (A_{62}), geographic binding index (A_{63}), choice preference (A_{64}), and representation (A_{65}).

4.1.2. Screening implementation of assessment indicators

First, the first round of questionnaires were constructed using a five-point Likert scale for the initially screened assessment indicators and distributed to the expert panel. After collecting the questionnaires, the data were analyzed for reliability and validity using SPSS software to ensure the reliability and internal consistency of the questionnaires. Subsequently, a screening threshold was set based on the mean value of the experts' ratings for each indicator, and those indicators that did not reach the threshold were excluded. At the same time, the open-ended feedback provided by the experts was synthesized to optimize the assessment indicators in order to improve the accuracy of the follow-up questionnaire.

(1) Reliability and validity questionnaire analysis

Given that this topic involves interdisciplinary fields such as economics and design, 10 experts and scholars from related fields were specially invited to form a decision-making panel to ensure the professionalism and scientificity of the questionnaire. The questionnaire survey was distributed offline, and was conducted between June 12, 2024 and July 25, 2024, with 15 questionnaires distributed and a recovery rate of 100%. After the questionnaire data were recovered, the data were analyzed for reliability with the help of SPSS statistical software to assess internal consistency. Section Cronbach's alpha coefficient was used as an assessment criterion in this study, and according to statistical principles, alpha values higher than 0.7 indicate good reliability. The analysis results show that the alpha coefficients of the assessment indicators of each dimension range from 0.927 to 0.945, and the overall alpha coefficient is 0.938, while the alpha value of the standardized items is 0.941, which indicates that the present

assessment system has a high degree of stability. Meanwhile, the results of validity test showed that the KMO value reached 0.912, the significance value of Barlett's spherical test was 0.002<0.05, and the cumulative variance explained rate after rotation reached 87.64%, indicating that the questionnaire has good validity.

(2) Formal questionnaire analysis

Through the validity and reliability questionnaire, the distribution of the formal questionnaire began on October 15, 2024, and 20 experts and scholars covering the fields of tourism, art and design, materials and crafts, as well as college teachers and industry workers were invited to participate in filling out the questionnaire. By November 20, 2024, 17 valid questionnaires were returned, with a recovery rate of 90%. The expert consensus value, threshold value and test value of each assessment factor were calculated by SPSS analysis, and the statistics of detailed assessment indexes of the fuzzy Delphi method expert questionnaire are shown in Table 1. Six assessment indicators with threshold values lower than 6.24 were excluded, and it was decided to keep two of them below the threshold value after discussion with experts, and finally a total of 16 assessment indicators entered the final model of the study.

Table 1. Statistics of evaluation indicators of the Fuzzy Delphi Method expert questionnaire.

Dimension	Index	Conservative estimate		Optimistic assessment		Geometric mean			Identification value	Expert consensus value	Remarks
		C_L^i	C_U^i	O_L^i	O_U^i	C_M^i	O_M^i	Single value	$M^i - Z^i$	G^i	
A_1	A_{11}	2	5	6	10	3.86	7.12	5.83	4.26	5.49	Reserve
	A_{12}	3	6	7	10	4.62	8.54	6.21	4.92	6.58	Reserve
	A_{13}	1	7	7	10	3.51	8.03	6.18	4.52	5.77	Reserve
	A_{14}	3	6	7	10	4.57	8.25	6.32	4.68	6.41	Reserve
	A_{15}	1	6	7	10	3.38	8.16	5.53	5.78	5.77	Delete
A_2	A_{21}	4	7	7	10	5.64	8.75	6.72	3.11	7.20	Reserve
	A_{22}	4	7	7	10	4.96	8.61	6.54	3.65	6.79	Reserve
A_3	A_{31}	6	7	7	10	6.95	8.82	6.73	1.87	7.89	Reserve
	A_{32}	2	7	7	10	4.52	8.67	6.08	4.15	6.56	Reserve
	A_{33}	3	6	6	10	4.77	8.98	6.72	4.21	6.88	Reserve
A_4	A_{41}	2	7	6	10	4.63	8.54	6.08	2.91	6.59	Reserve
	A_{42}	2	6	5	10	3.82	7.95	6.21	3.13	5.89	Delete
	A_{43}	4	7	7	10	5.64	9.15	6.83	3.51	7.34	Reserve
A_5	A_{51}	2	6	5	10	4.41	8.32	6.36	2.91	6.37	Reserve
	A_{52}	2	5	6	10	4.38	7.97	6.75	4.59	6.18	Delete
	A_{53}	2	5	5	10	4.32	7.68	6.14	3.36	6.00	Reserve
	A_{54}	2	7	5	10	4.36	7.83	6.18	1.47	6.10	Delete
A_6	A_{61}	3	7	7	10	4.68	8.95	6.69	4.27	6.82	Reserve
	A_{62}	3	6	5	10	4.52	7.86	6.32	2.34	6.19	Delete
	A_{63}	2	6	6	10	4.05	7.88	6.12	3.83	5.97	Delete
	A_{64}	4	8	7	10	5.34	9.15	6.29	2.81	7.25	Reserve
	A_{65}	2	7	7	10	4.59	8.97	6.46	4.38	6.78	Reserve
Total indicators number	22	Select the percentage		73%		The threshold value is 6.24					
Selected indicators number	16										

4.1.3. Established system of assessment indicators

After the study of fuzzy Delphi method, the index system used for the assessment of brand influence of tourism souvenirs was finally determined as shown in Table 2.

Table 2. Evaluation indicators for the brand influence of tourist souvenirs.

Dimension	Number	Index	Number
Brand awareness	A_1	Media attention	B_1
		Social discussion level	B_2
		Brand account image	B_3
		The popularity of the scenic spot	B_4
Brand awareness	A_2	Product awareness	B_5
		Service awareness	B_6
Brand reputation	A_3	Proportion of positive emotions	B_7
		Response timeliness for negative reviews	B_8
		UGC creation intention	B_9
Brand satisfaction	A_4	Exceeding Expectations index	B_{10}
		Add-on purchase conversion rate	B_{11}
Brand loyalty	A_5	Intention to repurchase	B_{12}
		Recommendation degree	B_{13}
Brand preference	A_6	Premium acceptance	B_{14}
		Choice preference	B_{15}
		Representativeness	B_{16}

4.2. Establishment of weights for the indicator model

4.2.1. Construction of two-by-two comparison judgment matrices

This study invites 32 experts, including platform managers, investment promotion executives, designer brand managers, buyer store managers and university professors, who have been deeply engaged in the field of tourism souvenir brands for many years, to make comparative ratings. The results of the questionnaire of two-by-two comparison of influencing factors are input into yannp software after data processing, which can be used for the subsequent calculation of the supermatrix, weighted supermatrix and limit supermatrix, and ultimately get the weights of the indicators in the evaluation system of tourism souvenir brand influence indicators.

In the process of calculation, yannp software will test the consistency of the judgment matrix in the process of calculation, and if the coefficient of determination is less than 0.1, it indicates that the weights are acceptable. This study directly in the software to produce the consistency test results of the judgment matrix, product awareness dimension under the index judgment matrix shown in Figure 2, Inconsistency = 0.07154 < 0.1, indicating that the consistency of the group of matrices is good, the data is valid.

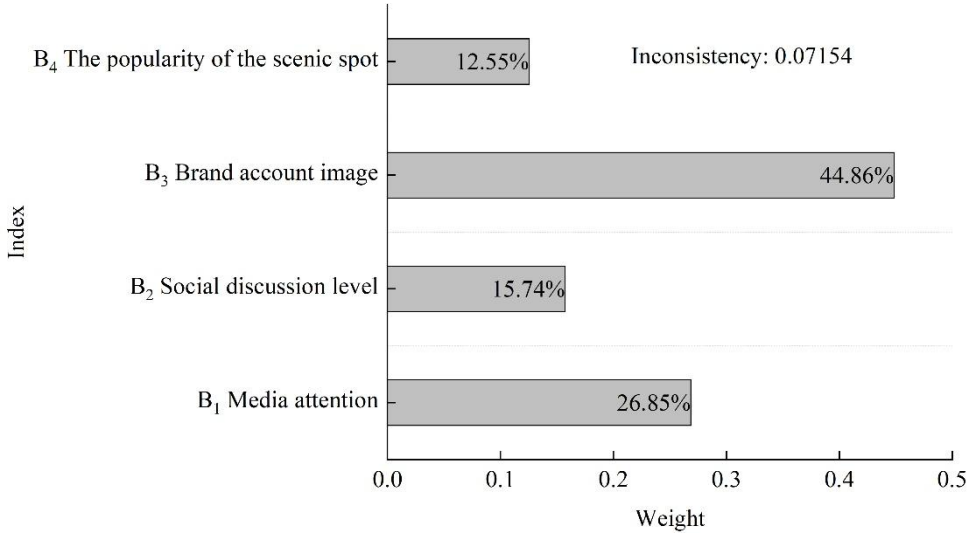

Figure 2. Consistency test results of "brand awareness".

After testing, all the control indicator groups of the model built in this thesis, the consistency test results are lower than 0.1, that is, all the judgment matrices pass the consistency test and the eigenvalues obtained are available.

4.2.2. Results and analysis of final weighting of indicators

Further calculating the hyper matrix of each indicator and the priority ranking of indicators, the final weight of each indicator is summarized as shown in Table 3.

From the results of the indicator weights, it can be seen that the most critical first-level indicator factor for the brand influence of tourism souvenirs is brand satisfaction, with a weight of 0.2253, followed by brand awareness, with a weight of 0.1835, which confirms the core position of brand satisfaction and brand awareness in shaping brand influence. The last four are brand preference, brand reputation, brand loyalty, and brand awareness, with weights of 0.1694, 0.1684, 0.1385, and 0.1149, respectively, reflecting the important influence of brand word-of-mouth and preference on brand influence. In the weight ranking of the secondary indicators, it can be understood that the top five factors with the greatest degree of influence on brand power are the conversion rate of add-on purchases, the index of exceeding expectations, the willingness to repeat purchases, the proportion of positive emotions, and the degree of recommendation, which illustrates the positive role of satisfying customer needs and cultivating loyal customers in shaping brand influence.

Table 3. Ranking results of weights for each indicator.

Dimension	Weight	Index	Weight	Comprehensive weight	Sorting
A_1	0.1835	B_1	0.2423	0.0445	15
		B_2	0.2267	0.0416	16
		B_3	0.2786	0.0511	9
		B_4	0.2524	0.0463	13
A_2	0.1149	B_5	0.5576	0.0641	7
		B_6	0.4424	0.0508	10
A_3	0.1684	B_7	0.4273	0.0719	4
		B_8	0.2943	0.0496	11
		B_9	0.2784	0.0469	12
A_4	0.2253	B_{10}	0.3561	0.0802	2
		B_{11}	0.6439	0.1451	1
A_5	0.1385	B_{12}	0.5327	0.0738	3
		B_{13}	0.4673	0.0647	5
A_6	0.1694	B_{14}	0.2674	0.0453	14
		B_{15}	0.3789	0.0642	6
		B_{16}	0.3537	0.0599	8

4.3. Tourism Souvenir Brand Ranking and Validation

On the basis of quantifying the indicators using social media data, the 50 tourism souvenir brands researched were scored on each indicator, and then standardized according to the weights of the brand power assessment model, and the final calculation yielded a comprehensive score for the influence of each brand as shown in Table 4. Among the TOP10 brands, the cultural and creative brand of the Palace Museum leads with a score of 6.97524, the second is the Dunhuang Research Institute Cultural and Creative Center brand with a score of 6.73592, and the brand of the Japanese Shrine Fringe Shop is listed in the third place with a score of 6.72143, showing the diversified development of the echelons of tourism souvenir brands with different styles in a big pattern.

After validation, the results of this study present an 80% overlap with the 2024 list released by the authoritative website of tourism souvenir ranking (χ^2=4.56, $p<0.05$), confirming that the ranking system has a high degree of efficiency, verifying the model's ability to capture the core brand power elements, which not only reflects that the evaluation model is able to capture the timely adjustment of brand strategy by handling the dependency relationship between indicators through the ANP method, but also highlights the scientific validity of the evaluation model. It not only reflects the scientific nature of the evaluation model that can timely capture the adjustment of brand strategy by dealing with the dependency relationship between indicators through the ANP method, but also highlights the objectivity of formulating standardized quantitative rules for subjective indicators, which can reduce human subjective bias.

Table 4. TOP10 ranking of tourist souvenir brand influence assessment.

Ranking	Brand	Score
1	Palace Museum Cultural Creativity	6.97524
2	Dunhuang Academy Souvenir Store	6.73592
3	Shrine Omamori Shop	6.72143
4	Louvre Musée Boutique	6.64281
5	British Museum Shop	6.57128
6	Pompeii Excavation Souvenirs	6.54816
7	Chiang Mai Sunday Market	6.44257
8	Marrakech Souk	6.33852
9	Windmill Village Workshop	6.24615
10	Māori Cultural Centre	5.97684

5. Conclusion

Based on the fuzzy Delphi method and network hierarchical analysis, this study realizes the construction of brand influence assessment model for tourism souvenirs and tests the validity of the model.

The brand influence assessment system of tourism souvenirs constructed in this paper contains 6 dimensions, which are subdivided into 16 specific indicators. The first-level indicators are, in descending order of weight, brand satisfaction, brand awareness, brand preference, brand reputation, brand loyalty, and brand cognition, with corresponding weights of 0.2253, 0.1835, 0.1694, 0.1684, 0.1385, and 0.1149, respectively, which reflect the important roles of brand word-of-mouth and preference in the shaping of brand influence. In the weight ranking of secondary indicators, the top five factors are add-on conversion rate, exceeding expectations index, repeat purchase willingness, positive sentiment percentage and recommendation degree, which illustrate the positive role of satisfying customer needs and cultivating loyal customers in shaping brand influence. In addition, the results of this study present an 80% overlap with the 2024 annual list released by the authoritative website of tourism souvenir ranking (χ^2=4.56, p<0.05), which confirms that the model is able to effectively capture the right core brand power elements, and is capable of the task requirements of tourism souvenir brand influence assessment.

Based on the empirical findings, this study summarizes the development suggestions and marketing strategies for tourism souvenir brands, including focusing on high-weighted areas, improving customer stickiness, and optimizing products to meet the high expectations of customers, etc., with a view to providing useful references for the development of tourism souvenir brands, and to enhance the competitiveness and influence of the whole industry.

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