Decision analysis of college students' trip home stay

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Abstract

With the increase of college students' traveling frequency and the restriction of economic ability, the non-standard accommodation industry is increasingly recognized and favored by students. It is a common problem to find out how to find the most suitable home stay in a large number of different residential areas. In this paper, through the analysis of the various conditions and facilities of a home stay facility has indicators, we establish a mathematical model based on analytic hierarchy process, determine the weight of each factor, solve the model by Matlab, select the most suitable for home stay facility.

Keywords

Dali home stay; Matlab; analytic hierarchy process; comprehensive evaluation system

Academic Discipline and Sub-Disciplines

Strategic Analysis

SUBJECT CLASSIFICATION

Strategic Analysis

TYPE (METHOD/APPROACH)

Mathematical Modeling

Introduction

In recent years, with the improvement of the consumption level of college students, the frequency of the travel has greatly improved. As a result of the limitation of college students’ economic level, the home stay facility, as small family hotels by personal business, is a non-standard accommodation industry, have certain price advantage, has become many college students travel choice. Home stay operators can attract customers by combining the local natural scenery, culture and their own experience and experience to provide guests with a more distinctive home stay. How to choose from a large number of residential areas for passengers, and how to improve the conditions of home stay through the preferences of passengers for home stay operators have become a hot topic.

Based on the above situation, many people are engaged in the study of travel related topic. For example, Zhang[1] made a study of tourists’ expectation and perception by way of IPA method through interviews with expectation and perception. Ding[2] introduced a Webqual-based system for evaluating the qualities of B2C e-commerce websites, improved it in consideration of the features of travel agencies’ business, and built a comprehensive evaluation model for the service quality of travel agencies’ websites in combination with the entropy method. Ma[3] studied travel agency service quality. Han[4] proposed a study model including customer psychological empowerment, customer participation, customer service quality, employee service quality and customer satisfaction and tested the model in travel agencies. Yang[5] investigated the optimal decision of service quality in tourism supply chain for package holiday including a theme park and tour operators. Chen[6] studied on the management of the service quality promotion of traditional travel agencies under the new normal. In recent years, there has been some research on home stay. For example, Ma[7] discerned the concept of tourist' interaction and its constructs, postulate the relationship among tourists' interaction, experiential value and subjective well-being and construct relevant hypothesis.
Analytic hierarchy process is a systematic and hierarchical analysis method combining qualitative and quantitative analysis. Its principle is that a complex problem is decomposed into a number of factors, the factors make up a class hierarchy according to the dominated relationship, through analysis and comparison, the total order of relative importance of the decision scheme is set, which provide quantitative basis for controlling things development. In this paper, we construct the home stay model using analytic hierarchy process. In this model, we establish a comprehensive evaluation index system for a home stay, which is based on the experience of travelers and stands at the angle of the home stay operator. The indicator evaluation system can be used as a reference for the operators and managers of home stays. The operators of home stays can improve their operations based on their own deficiencies. On the passenger's point of view, the residents of the home stay can comprehensively consider a home stay based on this indicator system to choose whether or not to stay. In theory, it provides a theoretical guide for the study the purchase decision-making psychology and purchase behavior for scholars [8].

2 Models

2.1 Model analysis

With the gradual increase of people's consumption level in recent years, the proportion of tourism is increasing. As an independent group, college students have abundant time and a certain curiosity, which lays the foundation for their journey. Due to the limit of the economic ability to college students, they stay the home stay facility or hostel where more focus on local characteristics. Next, we take the four home stay facilities of Dali as an example to build the model through comprehensive consideration of price, infrastructure, convenient transportation, surrounding environment, service and characteristics, network evaluation and other evaluation indexes. It shows the basic situation of four home stays in Table 1.

<table>
<thead>
<tr>
<th>Table 1 Home stay list in Dali</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Ancient City Spirit Hostel</td>
</tr>
<tr>
<td>Clean Courtyard</td>
</tr>
<tr>
<td>Star Room</td>
</tr>
<tr>
<td>Erhai Panoramic House</td>
</tr>
</tbody>
</table>

2.2 Building model

The tree hierarchical structure diagram is constructed according to each evaluation index of table 1 as shown in the figure 1, the structure diagram is divided into three layers and the highest level is the target layer (O): choosing the best home stay; the middle layer is the criterion layer (B): it is the factor that the college student considers during choosing the best home stay, namely the price(PR), the infrastructure(IN), the convenient transportation(CT), the surrounding environment(SE), the service and characteristics(SC) and the network evaluation(NE); The bottom layer is the scheme layer (D): the four home stays for the college students' trip, that is, the ancient city spirit hostel(ACSH), the clean courtyard(CC), the star room(SR), Erhai panoramic house(EPH).
According to the criterion layer of figure 1, the influence degree of various factors on the target layer is different. In order to prevent the difficult comparison of different factors, in this paper, the relative scale scale[9] is used for comparison as shown in table 2.

**Figure 1 Hierarchical structure diagram of home stays in Dali**

Table 2  Relative scale scale

<table>
<thead>
<tr>
<th>Scale values $b_{ik}$</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Impact of between $B_i$ and $B_k$ is same</td>
</tr>
<tr>
<td>3</td>
<td>Impact of $B_i$ is a little bit important than $B_k$</td>
</tr>
<tr>
<td>5</td>
<td>Impact of $B_i$ is obviously important than $B_k$</td>
</tr>
<tr>
<td>7</td>
<td>Impact of $B_i$ is much more important than $B_k$</td>
</tr>
<tr>
<td>9</td>
<td>Impact of $B_i$ is extremely important than $B_k$</td>
</tr>
<tr>
<td>2,4,6,8</td>
<td>Impact of $B_i$ and $B_k$ is between the above adjacent levels.</td>
</tr>
<tr>
<td>1,1/3,...,1/9</td>
<td>Impact ratio of $B_i$ and $B_k$ is the reciprocal of $b_{ik}$ of the above</td>
</tr>
</tbody>
</table>
The matrix composed of the elements $b_{ik} (i,k = 1, 2, \ldots, n)$ is called $B = (b_{ik})_{m \times n}$, which is called the comparison matrix. During the selection of the best home stays, the following matrix $B$ is obtained through the collection and integration of the conditions of college students' home stays through questionnaire survey, interview and online data access, etc. The matrix is as follows:

$$B = \begin{pmatrix}
1 & 1/2 & 5 & 4 & 6 & 8 \\
2 & 1 & 6 & 7 & 8 & 9 \\
1/5 & 1/6 & 1 & 1/3 & 3 & 7 \\
1/4 & 1/7 & 3 & 1 & 4 & 8 \\
1/6 & 1/8 & 1/3 & 1/4 & 1 & 5 \\
1/8 & 1/9 & 1/7 & 1/8 & 1/5 & 1
\end{pmatrix}$$

Compare the six factors of four schemes in the scheme layer according to the order, the comparison matrix $B_1, B_2, B_3, B_4, B_5, B_6$ is obtained as follows:

$$B_1 = \begin{pmatrix}
1 & 1/7 & 1/3 & 1/5 \\
7 & 1 & 5 & 3 \\
3 & 1/5 & 1 & 1/3 \\
5 & 1/3 & 3 & 1
\end{pmatrix} \quad B_2 = \begin{pmatrix}
1 & 5 & 3 & 3 \\
1/5 & 1 & 1/3 & 1/3 \\
1/3 & 3 & 1 & 1 \\
1/3 & 3 & 1 & 1
\end{pmatrix}$$

$$B_3 = \begin{pmatrix}
1 & 1 & 1/3 & 1/3 \\
1 & 1/3 & 1/3 \\
3 & 3 & 1 & 1 \\
3 & 3 & 1 & 1
\end{pmatrix} \quad B_4 = \begin{pmatrix}
1 & 3 & 3 & 3 \\
1/3 & 1 & 1 & 1 \\
1/3 & 1 & 1 & 1 \\
1/3 & 1 & 1 & 1
\end{pmatrix}$$

$$B_5 = \begin{pmatrix}
1 & 5 & 5 & 3 \\
1/5 & 1 & 1 & 1/3 \\
1/5 & 1 & 1 & 1/3 \\
1/3 & 3 & 3 & 1
\end{pmatrix} \quad B_6 = \begin{pmatrix}
1 & 1/3 & 3 & 1/3 \\
3 & 1 & 5 & 1 \\
1/3 & 1/5 & 1 & 1/5 \\
3 & 1 & 5 & 1
\end{pmatrix}$$

Then we solve the maximum characteristic root and the relative weight vector of the matrix $B$ and $B_k (k = 1, 2, 3, 4, 5, 6)$ and get table 3 and table 4 as follows:
Table 3 Maximum characteristic root and relative weight vector of matrix $B$

<table>
<thead>
<tr>
<th>$\omega^{(2)}$</th>
<th>0.2668</th>
<th>0.4301</th>
<th>0.1355</th>
<th>0.0936</th>
<th>0.0463</th>
<th>0.0277</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\lambda$</td>
<td>6.4677</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4 Maximum characteristic root and relative weight vector of matrix $B_k$

<table>
<thead>
<tr>
<th>$k$</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\omega^{(3)}_k$</td>
<td>0.0569</td>
<td>0.5193</td>
<td>0.1250</td>
<td>0.5000</td>
<td>0.5549</td>
<td>0.1535</td>
</tr>
<tr>
<td>$\lambda_k$</td>
<td>4.1185</td>
<td>4.0436</td>
<td>4</td>
<td>4</td>
<td>4.0435</td>
<td>4.0439</td>
</tr>
</tbody>
</table>

Set $B$ is $n$ order comparison matrix, $\lambda_{\text{max}}$ is the largest characteristic root of $B$, then the consistency index of $B$ is

$$CI = \frac{\lambda_{\text{max}} - n}{n - 1}$$

In order to determine the permissible range of inconsistency of $B$, the random consistency index $RI$ is introduced. $RI$ is usually determined. According to different $n$, the value of $RI$ is different, which is shown in table 5.

Table 5 Values of random consistency index $RI$

<table>
<thead>
<tr>
<th>$n$</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>$RI$</td>
<td>0</td>
<td>0</td>
<td>0.58</td>
<td>0.90</td>
<td>1.12</td>
<td>1.24</td>
<td>1.32</td>
<td>1.41</td>
<td>1.45</td>
<td>1.49</td>
<td>1.51</td>
</tr>
</tbody>
</table>

In table 5, when $n = 1,2$, $RI = 0$, it means 1,2 order comparison matrix must be consistent. When $n \geq 3$, The ratio between the consistency index $CI$ of the $n$-order comparison matrix and the same order random consistency index $RI$ is the consistency ratio index, which is denoted as $CR$. Then we get the consistency index of $B$ as follows:

$$CI^{(2)} = \frac{6.4677 - 6}{6 - 1} = 0.0935$$

$$CR^{(2)} = \frac{CI^{(2)}}{RI^{(2)}} = \frac{0.0935}{1.24} = 0.0754 < 0.1$$

It passes the consistency check, so $\omega^{(2)} = (0.2668, 0.4301, 0.1355, 0.0936, 0.0463, 0.0277)$ could be the relative weight vector. In the same way, the consistency index and the consistency ratio index of $B_k$ $(k = 1,2,3,4,5,6)$ are get in table 6.
Table 6 Consistency index and consistency ratio index of $B_k$ ($k = 1, 2, 3, 4, 5, 6$)

<table>
<thead>
<tr>
<th>$k$</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>$CI_k^{(3)}$</td>
<td>0.0395</td>
<td>0.0145</td>
<td>0</td>
<td>0</td>
<td>0.0145</td>
<td>0.0146</td>
</tr>
</tbody>
</table>

From table 6 we get $CR_k < CR_k^{(3)}$, so the consistency check is all passed. $W^{(3)}$ represents the weight vector of the scheme layer to each element of the criterion layer as follows:

$$W^{(3)} = \begin{pmatrix} 0.0569 & 0.5193 & 0.1250 & 0.5000 & 0.5549 & 0.1535 \\ 0.5579 & 0.0789 & 0.1250 & 0.1667 & 0.0967 & 0.3889 \\ 0.1219 & 0.2009 & 0.3750 & 0.1667 & 0.0967 & 0.0687 \\ 0.2633 & 0.2009 & 0.3750 & 0.1667 & 0.2516 & 0.3889 \end{pmatrix}$$

Therefore, the combined weight vector of the scheme layer to the target layer is $\omega^{(3)} = W^{(3)} \omega^{(2)} = (0.3323, 0.2047, 0.1917, 0.2454)^T$.

Composite consistency check: $CI^{(3)} = (CI_1^{(3)}, CI_2^{(3)}, CI_3^{(3)}, CI_4^{(3)}, CI_5^{(3)}, CI_6^{(3)})$ $\omega^{(2)} = 0.0178$, the composite consistency ratio is $CR^{(3)} = CR^{(2)} + \frac{CI^{(3)}}{RI^{(3)}} = 0.0952 < 0.1$, the consistency check is passed. Therefore, the whole level can be determined to pass the consistency test, and the combined weight vector $\omega^{(3)}$ can be used as the final consistency test. From $\omega^{(3)}$ we get the ancient city spirit hostel is the best location for home stays.

2.3 Model results

As a result, the basic facilities, safety and price of the home stay were put first in college students’ choice of home stays, which is consistent with the results of the questionnaire survey. It is also related to students’ limited economic ability.

Disadvantages of the model are as follows: limitations of data collection; the applicability of the index system; the rigor of the index name.

3 Conclusions

In this paper, we analyze the home stay facility decision problem of university student by building the hierarchical analysis model, which play a guiding role to choose the home stay facility for college students and make the operator of home stay facility better understand travelers’ preference. It plays a promoting role to the development of home stay facility.
4 Acknowledgements
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References