An Analysis of tourist satisfaction of Scenic spots in Pingliang based on Fuzzy Comprehensive Evaluation method

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Abstract. There are some basic steps of the fuzzy comprehensive evaluation method of constructing the satisfaction index system, establishing the weight set, determining the evaluation set, establishing the evaluation matrix, the paper comprehensively evaluates the tourists satisfaction in Pingliang scenic spots.

1. Introduction
The Fuzzy comprehensive evaluation method is a comprehensive evaluation method based on fuzzy mathematics, which is developed on the basis of fuzzy set theory put forward by Professor Richard, an automatic control expert in the United States. The method converts qualitative evaluation into quantitative evaluation, which solves the problem that all kinds of factors that affect the evaluation object are vague and difficult to quantify. Since its introduction, the method has achieved remarkable results in many fields, such as customer satisfaction, performance appraisal, transportation, environmental quality, construction and real estate, medical diagnosis, voice recognition, image processing, market prediction and so on. The CNKI shows that more than 150 articles on tourists satisfaction are analyzed by fuzzy mathematics analysis method. The research objects are concentrated in scenic spots, parks, leisure tourism and so on, and the research fields focus on some well-known scenic spots such as scenic southern cities, southwest areas and ancient capitals. Although Pingliang City has always had Longshang dry wharf, an important town which the Silk Road must pass through, has a long history, profound cultural heritage, rich tourism resources, and has a number of national key scenic spots such as Kongtong Mountain, Royal Palace, Gulingtai and Lianhuatai, but the attention to the tourism resources is still insufficient in Pingliang.

2. Construct the index system of satisfaction
The selection of satisfaction index mainly refers to the previous research literature, combined with the actual situation of tourists in various scenic spots in Pingliang City, and synthesizes the three-level satisfaction evaluation system (Fig. 1). The first level is the target layer, that is, the overall satisfaction of tourists; the second level is the criterion layer, which consists of food, housing, travel, purchase, entertainment and supporting facilities, and the third level is the factor layer, which is composed of 23 specific evaluation factors. In the study, the first level index is defined as \( U = \{ U_1, U_2, U_3, U_4, U_5, U_6, U_7 \} \), and the second level index is defined as \( U_i = \{ u_{i1}, u_{i2}, u_{i3}, u_{i4}, u_{i5} \} = \) (very satisfactory, general, unsatisfactory, very unsatisfactory).
3. Create a weight set

Because the importance of each index in the satisfaction index system is different, the first index and the second index should be given the corresponding weight number respectively. In the study, the weight set of the first grade index $U$ is defined as $W = \{W_1, W_2, W_3, W_4, W_5\}$, and the weight set of the secondary index $U_i$ is defined as $W_i = \{W_{i1}, W_{i2}, W_{i3}, W_{i4}, W_{i5}\}$. In the survey, each visitor was asked to select the seven secondary indicators that he or she considered to be the most important, and it was equally important to set each indicator in the study. The final weight set is composed of the total number of times each index is selected as a proportion of the total number of samples. The satisfaction evaluation results of each factor counted by excel are shown in Table 1.

| First index | weight | Second index | weight |
|-------------|--------|--------------|--------|
| food        | 0.168  | Health       | 0.369  |
|             |        | characteristics | 0.448 |
|             |        | price         | 0.183  |
| stay        | 0.100  | Environment   | 0.516  |
|             |        | convenience   | 0.241  |
|             |        | price         | 0.244  |
| walk        | 0.057  | Price         | 0.547  |
|             |        | comfort       | 0.196  |
|             |        | convenience   | 0.257  |
| tour        | 0.174  | Landscape layout rationality | 0.422 |
|             |        | tourism line rationality | 0.221 |
|             |        | scenic spot service rich | 0.358 |
| shop        | 0.166  | Price         | 0.265  |
Table 1 shows that tourists pay more attention to entertainment, swimming and food. The weighting coefficients of the three groups are 22%, 17.4% and 16.8% respectively, while for housing, the overall value of the row is less important, and the weight coefficient is lower (10% and 5.7%, respectively). The importance of purchasing and supporting facilities was 16.6% and 11.4%, respectively.

### 4. Determine the evaluation set

The fuzzy scale set of each index is defined, that is, the evaluation set is \( V = (V_1, V_2, V_3, V_4, V_5) = \) (very satisfactory, satisfactory, general, discontent, very discontent).

### 5. Establish the evaluation matrix

The evaluation matrix is used to reflect the membership relationship of all levels of indicators to the evaluation level, which is defined as \( R_i = (r_{i1}, r_{i2}) \). In the study, in order to reflect the objective reality more accurately, the satisfaction evaluation results of the secondary indicators are counted strictly according to the results of the questionnaire. The evaluation matrix is determined by the proportion of the total number of satisfaction evaluation of each secondary index to the total number of samples. The satisfaction evaluation results of each factor counted by excel are shown in table 2.

| First index | Second index       | very | satisfactory | normal | discontent | Very discontent |
|-------------|--------------------|------|--------------|--------|------------|-----------------|
| food        | Food Health        | 0.293| 0.351        | 0.289  | 0.067      | 0.000           |
|             | Food characteristics| 0.100| 0.367        | 0.269  | 0.173      | 0.091           |
|             | Food price         | 0.118| 0.407        | 0.271  | 0.204      | 0.000           |
| stay        | Stay Environment   | 0.224| 0.571        | 0.193  | 0.011      | 0.000           |
|             | Stay convenience   | 0.307| 0.424        | 0.200  | 0.062      | 0.007           |
|             | Stay price         | 0.149| 0.402        | 0.364  | 0.069      | 0.016           |
| walk        | Traffic Price      | 0.416| 0.280        | 0.216  | 0.064      | 0.024           |
|             | Traffic comfort    | 0.102| 0.431        | 0.336  | 0.109      | 0.022           |
|             | Traffic convenience| 0.302| 0.527        | 0.120  | 0.042      | 0.009           |
| tour        | Landscape layout rationality | 0.182| 0.320 | 0.447 | 0.038 | 0.013 |
|             | tourism line rationality | 0.173| 0.260 | 0.442 | 0.089 | 0.036 |
|             | scenic spot service rich | 0.213| 0.389 | 0.280 | 0.098 | 0.020 |
| shop        | Shop Price         | 0.087| 0.331        | 0.480  | 0.060      | 0.042           |
|             | Shop feature       | 0.073| 0.407        | 0.442  | 0.038      | 0.040           |
|             | Shop variety       | 0.120| 0.478        | 0.331  | 0.047      | 0.024           |
| amuse       | Characteristic     | 0.273| 0.520        | 0.176  | 0.018      | 0.013           |
interest 0.202 0.436 0.211 0.073 0.078
ornamental 0.358 0.349 0.184 0.102 0.007
diversity 0.102 0.327 0.460 0.071 0.040
toilet 0.076 0.520 0.256 0.102 0.047
Scenic area capacity 0.284 0.518 0.191 0.002 0.004
payment convenience 0.404 0.536 0.051 0.007 0.002
Sanitation 0.211 0.393 0.264 0.107 0.024

Table 2 shows that tourists have a high overall evaluation of Pingliang Scenic spot, and only individual evaluation indicators are less satisfied. 41 people are very dissatisfied with the evaluation of catering characteristics, and 10 people are very dissatisfied with the evaluation of accommodation price and convenience. 25 people were very dissatisfied with the relevant index evaluation of the line, 31 people were very dissatisfied with the relevant index evaluation of travel, 48 people were very dissatisfied with the evaluation of the relevant index of purchasing, and 62 people were very dissatisfied with the evaluation of the relevant index of entertainment. Thirty-six people were not satisfied with the evaluation of the related indicators of the supporting facilities. The satisfaction coefficient of each second-order index can be expressed as a matrix relationship similar to formula 1, which is limited to space, and the satisfaction coefficient of other second-order indicators is not repeated here.

\[
R_1 = \begin{pmatrix}
0.293 & 0.351 & 0.289 & 0.067 & 0.000 \\
0.100 & 0.357 & 0.269 & 0.173 & 0.091 \\
0.118 & 0.407 & 0.271 & 0.204 & 0.000
\end{pmatrix}
\]

6. Determine the fuzzy comprehensive evaluation set

In the study, the comprehensive evaluation set is defined as \( B = W \times R \). According to the research data, the fuzzy comprehensive evaluation of each criterion layer and the target layer can be carried out respectively. the product results of each evaluation factor calculated by excel table are shown in tables 3 and 4.

| Index          | very   | satisfactory | normal | discontent | Very discontent |
|----------------|--------|--------------|--------|------------|-----------------|
| food           | 0.175  | 0.368        | 0.277  | 0.140      | 0.041           |
| stay           | 0.226  | 0.495        | 0.237  | 0.037      | 0.005           |
| walk           | 0.325  | 0.373        | 0.214  | 0.067      | 0.020           |
| tour           | 0.191  | 0.331        | 0.386  | 0.071      | 0.021           |
| shop           | 0.085  | 0.400        | 0.432  | 0.045      | 0.038           |
| amuse          | 0.279  | 0.392        | 0.226  | 0.078      | 0.025           |
| supporting facilities | 0.235 | 0.487       | 0.210  | 0.050      | 0.018           |

Table4. Values of Fuzzy Comprehensive Evaluation of Criterion layer

| Index                  | very   | satisfactory | normal | discontent | Very discontent |
|------------------------|--------|--------------|--------|------------|-----------------|
| Overall satisfaction of tourists | 0.206  | 0.399        | 0.295  | 0.074      | 0.026           |

7. Comprehensive evaluation

Using Euclidean closeness calculation method, the evaluation grade is determined as shown in Table 5.
Table 5. Values of euclidean closeness

| very     | satisfactory | normal | discontent | Very discontent |
|----------|--------------|--------|------------|-----------------|
| 0.605    | 0.704        | 0.534  | 0.550      | 0.552           |

8. Conclusion

According to Table 5, combined with the close principle of fuzzy mathematics theory, the subordinate vector of the target level corresponding to the evaluation grade is close to the second level evaluation. That is, the final result of tourist satisfaction in Pingliang Scenic spot is satisfactory. However, we also see that there is more or less poor tourist satisfaction in each secondary index. For example, tourists attach the highest importance to entertainment, but the evaluation is not too high, it can be seen that Pingliang scenic spots need to pay attention to the experience, interest and diversity of entertainment projects. The importance of tourism is in the second place, but nearly 30% of the people are not satisfied with the design of tourism route, the layout of scenic spot and the service level, while the importance of purchase is in the third place, and nearly 20% of the people are not satisfied with the specialty characteristics, pricing and richness. These unsatisfactory aspects bring challenges to scenic spot managers, but at the same time, it is also the opportunity. To a certain extent, the managers of scenic spots should not only consider improving the overall satisfaction of tourists through the construction of soft and hard years of scenic spots, but also highlight the characteristics of scenic spots to meet the personality needs of tourists, constantly improve the overall planning of scenic spots, highlight the construction of characteristics. Attach importance to detail design.

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