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한국관광·레저학회

THE KOREA ACADEMIC SOCIETY OF TOURISM AND LEISURE

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A Study of the Different Tourist Perception by Using an Application of Multi-level Gray Evaluation Method

Yingzhi Guo* · Jaekyoon Jun** · Kuo-Ching Wang*** · Hailin Qu****

Abstract

Tourist perception is a psychological process through which tourist obtain information on travel target, tourist environment termsof tourist destination through sense organ. The evaluation of tourist perception involves a lot of factors, and the appraising information is not complete and exact entirely, which determinants the gray nature of the evaluation system. Direct to this characteristic, taking the five main tourism destination in the Mega-Xi'an Tourism Circle for examples, and combining the AHP (Analytic Hierarchy Process) and Grey Theory, this article makes the comprehensive evaluation of tourist perception. The empirical study shows that the result of the multilevel evaluation of tourist perception is objective and reliable. It can offer basis for the decision-making of planning, management and marketing of tourist destination.

Key Words : tourist perception, multi-level gray evaluation

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I. INTRODUCTION

There was a wide range in studying tourist behavior including tourist behaviors in both direct and indirect space. Tourist behavior is one of the most important research fields (Lu, et al., 1996). Tourist behavior was defined as the psychologicalprocess of information in the perception on the tourist destinations and tourist environment. Clawson et al. (1966) put forward the "Recreation experience continuum", where the tourist process was divided into five paragraphs such as anticipation,travel to destination, returning travel, on site and recollection. The perceptions in the above each paragraph was different. It was helpful to richen and complete the research systems of tourist geography, to effect the tourist development, tourist product designing, tourist origin marketing by studying tourist behavior from the view of behavior geography (Chen, 1988). It was very meaningful in theory and practice to understand the tourist satisfaction, to improve and perfect quality of tourist products. This paper mainly studied the perception in paragraph of on-site tourist destination.

2. LITERATURE REVIEW

There was some researches about tourist perception. Chen (1988) had posted that perception behavior and up most benefit theory decided tourist decision behavior by means of hypothesis tests. Lu et al. (1996) had studied the tourist behavior in mountainous destination. Li et al. (2000) had practically studied the perception and evaluation about meal, accommodation, travel, shopping, recreation and social environment. Um et al. (1992) regarded that tourist products had the features of consumption and production. There was limited perception on tourist destination for potential tourists. Carmen et al. (1999) and Lue et al. (1993, 1999) had studied the tourist behavior modes and proved that many factors had something to do with multi-destination traveling. Murphy et al. (2002) discussed the relationship between tourist production combination and tourist perception

and analyzed the relationship between tourist perception and tourist re-visit tendency.

The tourist perception was the synthetic affections of tourist products and service perceived by tourists affected by many factors. There was un-known relationship between each factor and difficult to accurate each factor. It was considered to apply hierarchy analysis to synthetically analyze this kind of multi-level and complicated evaluation problem. The method of hierarchy analysis had a strong system and high reliability in recognizing problem (Zhao, et al., 1986). However, when the specialist consultant was adopted, it was easy to produce circle which would not meet the passing theory so as to loss some information led by un-accurately master standard (Xu, 1998). Meanwhile, tourist perceptionevaluation was based on the individual deflection, cultural background, experience and knowledge ability, which would difficult to eliminate the dispatch caused by many artificial factors. This would lead to the inaccurate evaluation information, or gray quality. In order to solve the above problems such as incomplete information and inaccurate information in the evaluation of tourist perception, an effective way was to combine the gray theory and hierarchy analysis. Gray system theory took uncertain system of "small example" and "sub-information" in "partial known information and partial unknown information"as study objects. The accurate description and effective inspection on system operational behavior and evolvement regulation had been realized by production, development and picking up useful information in " partial"known information. Gray system theory had apparent analyzing advantages in the system of inaccurate information and incomplete known information without strict demand for the number of samples (Deng, 1985). The combinationof hierarchy analysis and gray theory had been applied to the evaluation on irrigation management, enterprise competition power, investment risk and tourist resource evaluation with fairly high evaluation reliability (Zhao, et al., 2000; Hu, 2003; Cai, et al., 2003; Jiang, et al., 2000). This paper tried the method of multi-hierarchy gray evaluation into description of authority vector of different gray degree by detracting information perceived by tourists, on the base of which the single value had been dealt with and the synthetic evaluation value for tourist perception had been obtained and then be prior to be selected among

the evaluation objects.

3. STUDY METHOD

In order to evaluate tourist perception, the keyfactors affected tourist perception should be analyzed so as to set up rank multi-hierarchy evaluation index system, to assure the index weight of evaluation index, and to confirm the synthetic evaluation value of models.

The order of evaluated object was s=(s=1, 2, ..., q). W(s) stood for the synthetic value of the evaluated object of No. s. U stood for the gather of first-level evaluation index Ui, which was written as $U=(U_1, U_2, , U_m)$. It was written as Vi=(I=1, 2,..., m), which stood for the gathering of second-level evaluation index Vij, which as written as $Vi=(V_{i1}, V_{i2}, , V_{in})$. The steps of multi-hierarchy gray evaluation method were as follows (Deng, 1985; Liu, et al., 1999; Hu, et al., 1999).

Evaluation index V_{ij} was subject index, that is quality index, which could be realized to fixed quantity of quality index by making index grade standard. The importance of evaluation index U_i and V_{ij} were different, that is, there was different weight. The importance between two index could be compare by hierarchy analysis method so as to set up differential matrix and to try the weight with the method of solving matrix eigenvalue. The number of evaluations' orders were k, k=1, 2, ..., p, which meant there were p evaluations. The p evaluations were organized to grade the s evaluated objects by the evaluation index V_{ij} grading standard. According to the evaluation results, that is the grade, $d_{ijk}^{(s)}$, was given according the evaluation index V_{ij} on the s evaluated object by 9 evaluation. Then, the evaluation sample matrix $D^{(s)}$ for the s evaluated object was given out.

In order to assure the evaluation gray types, the grading number of evaluation gray types, gray number of gray types and whiten weight functions of evaluation gray types should be assured. Generally, it could be assured according to actual evaluation. The number of evaluation gray number were e,

e=1, 2, ..., g, that is, there were g evaluation gray types. One definite whiten weight function could be used to describe gray types according to actual situation. For evaluation index V_{ij}, the gray evaluation index was written as $x_{ije}^{(s)}$ belong to the e evaluation gray types for the s evaluated object. Then,

$$x_{ije}^{(s)} = \sum_{k=1}^{p} f_e(d_{ijk}^{(s)})$$

Total gray evaluation index was written as $x_{ij}^{(s)}$ belonging to each evaluation gray type for the s evaluated object. Then,

$$x_{ij}^{(s)} = \sum_{e=1}^{g} x_{ije}^{(s)}$$

The gray evaluation weight of the e gray type was written as $r_{ije}^{(s)}$ for the evaluation index V_{ij} by all evaluations. Then,

$$r_{ije}^{(s)} = \frac{x_{ije}^{(s)}}{x_{ij}^{(s)}}$$

Considering there were g of evaluation gray types, there was evaluation index V_{ij} for the s evaluated object comparing to the gray evaluation weight vector, $r_{ij}^{(s)}$, for each gray type:

$$r_{ij}^{(s)} = (r_{ij1}^{(s)}, r_{ij2}^{(s)}, \ldots, r_{ijg}^{(s)})$$

After intergrating the gray evaluation weight vector for each evaluation gray type with the index V_{ij} belonging to V_i on the s evaluated object, the gray evaluation index weight matrix $R_i^{(s)}$ could be given as follows,

$$R_i^{(s)} = \begin{bmatrix} r_{i1}^{(s)} \\ r_{i2}^{(s)} \\ \cdots \\ r_{in_i}^{(s)} \end{bmatrix} = \begin{bmatrix} r_{i11}^{(s)} & r_{i12}^{(s)} & \cdots & r_{i1g}^{(s)} \\ r_{i21}^{(s)} & r_{i22}^{(s)} & \cdots & r_{i2g}^{(s)} \\ \cdots & \cdots & \cdots & \cdots \\ r_{in_i1}^{(s)} & r_{in_i2}^{(s)} & \cdots & r_{in_ig}^{(s)} \end{bmatrix}$$

After synthetically evaluating the evaluated object V_i for the s evaluated

object, the evaluation result could be written as $B_i^{(s)}$. Then,

$$B_i^{(s)} = A_i \times R_i^{(s)} = (b_{i1}^{(s)}, b_{i2}^{(s)}, ..., b_{ig}^{(s)})$$

According to the synthetic evaluation result $B_i^{(s)}$ by Vi, the gray evaluation weight matrix of $R^{(s)}$ of each evaluation gray type for belonging index U_i for U on the *s* evaluated object.

$$R^{(s)} = \begin{bmatrix} B_1^{(s)} \\ B_2^{(s)} \\ \cdots \\ B_m^{(s)} \end{bmatrix} = \begin{bmatrix} b_{11}^{(s)} & b_{12}^{(s)} & \cdots & b_{ig}^{(s)} \\ b_{21}^{(s)} & b_{22}^{(s)} & \cdots & b_{2g}^{(s)} \\ \cdots & \cdots & \cdots & \\ b_{m1}^{(s)} & b_{m2}^{(s)} & \cdots & b_{mg}^{(s)} \end{bmatrix}$$

The synthetic evaluation of U on the s evaluated object could be written as $B^{(s)}$. Then,

$$B^{(s)} = A \times R^{(s)} = \begin{bmatrix} A_1 \times R^{(s)} \\ A_2 \times R_2^{(s)} \\ \cdots\cdots \\ A_m \times R_m^{(s)} \end{bmatrix} = (b_1^{(s)}, b_2^{(s)}, ..., b_g^{(s)})$$

Each gray type grading level could be valued according to "gray level" (threshold value). The first gray type was d1. The second gray type was d2. The g gray type was dg. There was grading value vector C=(d1, d2, ..., dg) for each gray type evaluation. Then, the synthetic value $W^{(s)}$ on the s evaluated object could be calculated as the following equation.

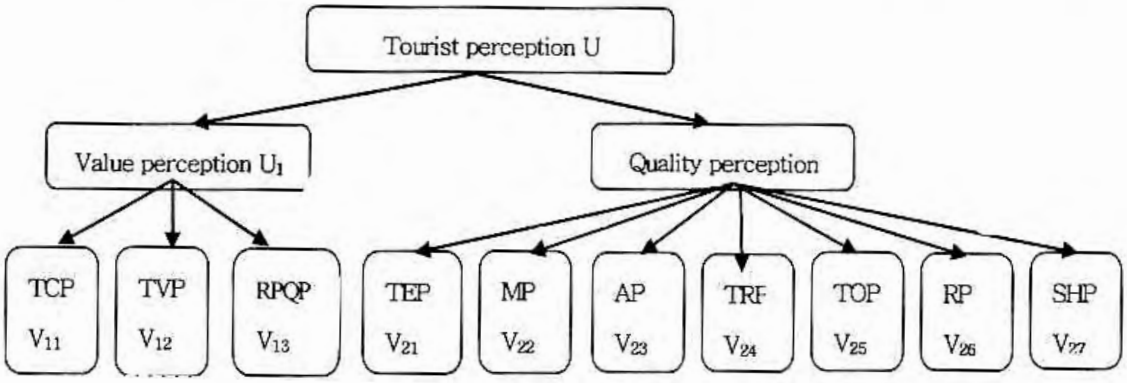
$$W^{(s)} = B^{(s)} \times C^T$$

According the value of $W^{(s)}$, the evaluation orders for the q evaluated object could be assured and be ordered.

4. STUDY DATA SOURCES

According to multi-hierarchy gray evaluation theory, the case study of multi-hierarchy gray evaluation for tourist perception had been done in the five main tourist destinations of mega-Xi'an such as Xi'an City, Lintong, Changan, Xianyang and Gaoling.

There were two inspects of value perception and quality perception for tourist perception (Murphy, et al., 2002). The tourist experiences had been made up of numerous "moment of truth". There were many factors of value perception and quality perception affected tourists. Firstly, 39 items of pre-election index for tourist perception had been selected according to science, comparison, completeness and accuracy as well as literature review (Murphy, et al., 2002; O'Nell, 1994; Gotlieb, 1994; Stevens, 1992; Zeitham, 1998). Secondly, the



〈Figure 1〉 The evaluation factor system of tourist perception

Notes: 1. TCP stands for total cost perception V11 TVP stands for Total value perception V12 RPQP stands for rate perception between quality and price V13 TEP stands for total environment perception V21 MP stands for meal perception V22; AP stands for accommodation perception V23 TRP stands for transportation perception V24 TOP stands for tour perception V25; RP stands for recreation perception V26 SHP stands for shopping perception V27.

2. Total cost includes currency cost, time cost, spirit cost, physical cost. Total value includes tourist product value, service value, image value. Total environment perception indicates tourist destination safe, climate, residents' friendly degree, tourist management and tourist service, etc.

pre-election index had been riddling and combining according to factor component factor analysis. The key index variables for tourist perception had replaced the numerous index variablesto reduce "spatial dimensions"so as to finally assure the evaluation index system of tourist perception (Figure 1). The study adopted Likert five-point scale to evaluate the values such as 5, 4, 3, 2, and 1 respectively stood for best, good, fair, bad, and worst.

Hierarch analysis method had been adopted to assure the each level evaluation index. The 20 specialists from Xi'an Tourism Administration Bureau and Universities in Xi'an had been selected to compare the important quality between two index by the standard theory of hierarchy analysis. Owing to the different opinions from specialist for the importance between index, the final standard index values between had reached after two discussions and the each evaluation index weight had been given. In that, U_i(I=1, 2) weight vector was A=(a_1, a_2)=(0.46, 0.54). Evaluation index V_{1j}(j=1, 2, 3) weight vector A1=(a_{11}, a_{12}, a_{13})=(0.32, 0.32, 0.36). Evaluation index V_{2j}(j==1, 2, , 7) weight vector A_2=(a_{21}, a_{22}, , a_{27})=(0.16, 0.15, 0.14, 0.12, 0.2, 0.12, 0.11).

The evaluation index system of tourist perceptions had been transferred into survey questionnaires. The survey of tourist perception on the above five tourist destinations in the airport, railway station, main hotels and restaurants as well as main attractions in Xi'an in had been investigated. The survey duration was twenty days from May 1 to May 20, 2005. In order to get complete and accurate evaluation information about tourist perception, the group sampling method had been adopted according to tourist source regions five groups such as Xi'an City, Shaanxi Province, Outside Province, Hong Kong and Taiwan, and Foreigners. 100 questionnaires were distributed to each group and respondents were asked to answer evaluation of their tourist perceptions about the five tourist destinations of Xi'an City, Lintong, Xianyang, Changan, and Gaoling. 500 questionnaires had been distributed in this survey while 471 useful questionnaires had collected with 95 questionnaires from Xi'an local travelers, 94 from Shaanxi province, 91 from outside province, 95 from travelers of Hong Kong, Macau, and Taiwan, and 96 from foreign travelers.

By means of SPSS statistical analysis, the average value for each evaluation index in each sample group was used as evaluation value of this index. The

evaluation sample matrix of tourist perception in the above five destinations could be given out.

$$D^{(Xi'an)} = \begin{bmatrix} d_{111}^{(1)} & d_{112}^{(1)} & d_{113}^{(1)} & d_{114}^{(1)} & d_{115}^{(1)} \\ d_{121}^{(1)} & d_{122}^{(1)} & d_{123}^{(1)} & d_{124}^{(1)} & d_{125}^{(1)} \\ d_{131}^{(1)} & d_{132}^{(1)} & d_{133}^{(1)} & d_{134}^{(1)} & d_{135}^{(1)} \\ d_{211}^{(1)} & d_{212}^{(1)} & d_{213}^{(1)} & d_{214}^{(1)} & d_{215}^{(1)} \\ d_{221}^{(1)} & d_{222}^{(1)} & d_{223}^{(1)} & d_{224}^{(1)} & d_{225}^{(1)} \\ d_{231}^{(1)} & d_{232}^{(1)} & d_{233}^{(1)} & d_{234}^{(1)} & d_{235}^{(1)} \\ d_{241}^{(1)} & d_{242}^{(1)} & d_{243}^{(1)} & d_{244}^{(1)} & d_{245}^{(1)} \\ d_{251}^{(1)} & d_{252}^{(1)} & d_{253}^{(1)} & d_{254}^{(1)} & d_{255}^{(1)} \\ d_{261}^{(1)} & d_{262}^{(1)} & d_{263}^{(1)} & d_{264}^{(1)} & d_{265}^{(1)} \\ d_{271}^{(1)} & d_{272}^{(1)} & d_{273}^{(1)} & d_{274}^{(1)} & d_{275}^{(1)} \end{bmatrix} \begin{matrix} V_{11} \\ V_{12} \\ V_{13} \\ V_{21} \\ V_{22} \\ V_{23} \\ V_{24} \\ V_{25} \\ V_{26} \\ V_{27} \end{matrix} = \begin{bmatrix} 4 & 4 & 4.3 & 5 & 5 \\ 4 & 4 & 4.1 & 4 & 4 \\ 4 & 3.9 & 4 & 4.5 & 4.6 \\ 4.9 & 5 & 4.7 & 4.9 & 5 \\ 4 & 4 & 3.2 & 3 & 3 \\ 4 & 3.5 & 4.1 & 4 & 4 \\ 4.6 & 4 & 3.8 & 4 & 4.9 \\ 3 & 3 & 3.5 & 3.4 & 4.1 \\ 3 & 3 & 3.5 & 3.4 & 4.1 \\ 3 & 3 & 3.2 & 3.8 & 4.3 \end{bmatrix}$$

$$D^{(Lintong)} = \begin{bmatrix} 4.2 & 4 & 4.2 & 5 & 5 \\ 4 & 4.1 & 4.2 & 4 & 4.2 \\ 4 & 4 & 3.9 & 4.1 & 4.5 \\ 4.4 & 4.6 & 4.2 & 4.8 & 4.8 \\ 3.5 & 3.5 & 3.2 & 4 & 3.5 \\ 3.6 & 3 & 3 & 3 & 3 \\ 4.2 & 4.1 & 4 & 4 & 4.7 \\ 4.6 & 4.8 & 4.8 & 4.9 & 4.8 \\ 4 & 4 & 3.6 & 4.2 & 4.2 \\ 3 & 3 & 4 & 4 & 4.3 \end{bmatrix} \qquad D^{(Xianyang)} = \begin{bmatrix} 4 & 4 & 4 & 4 & 4.2 \\ 3 & 3.5 & 3.5 & 3.8 & 4 \\ 3.6 & 3.9 & 3.8 & 4 & 4 \\ 4 & 4 & 4.1 & 4.2 & 4.2 \\ 3.5 & 3.4 & 3.2 & 3.4 & 3.4 \\ 3 & 3.1 & 3 & 3 & 3 \\ 3.5 & 3.2 & 3.2 & 3.5 & 3.5 \\ 4 & 4.1 & 4 & 4.2 & 4.3 \\ 3.5 & 3.8 & 3.5 & 3.5 & 3.5 \\ 3 & 3 & 3.1 & 3 & 3 \end{bmatrix}$$

$$D^{(Gaoling)} = \begin{bmatrix} 4 & 4 & 4 & 4.2 & 4.2 \\ 3.1 & 3 & 3 & 3 & 3 \\ 3 & 3 & 3 & 2.8 & 2.9 \\ 3 & 3 & 3 & 3 & 3 \\ 3 & 3.1 & 3 & 3.1 & 3 \\ 3 & 3 & 2.8 & 3 & 3 \\ 3 & 3 & 3 & 3.1 & 3.1 \\ 3.2 & 3.2 & 3 & 3 & 3 \\ 3 & 3 & 3.1 & 3.2 & 3.3 \\ 3 & 3.2 & 3 & 3 & 3 \end{bmatrix} \qquad D^{(Gaoling)} = \begin{bmatrix} 4 & 4 & 4 & 4.2 & 4.2 \\ 3.1 & 3 & 3 & 3 & 3 \\ 3 & 3 & 3 & 2.8 & 2.9 \\ 3 & 3 & 3 & 3 & 3 \\ 3 & 3.1 & 3 & 3.1 & 3 \\ 3 & 3 & 2.8 & 3 & 3 \\ 3 & 3 & 3 & 3.1 & 3.1 \\ 3.2 & 3.2 & 3 & 3 & 3 \\ 3 & 3 & 3.1 & 3.2 & 3.3 \\ 3 & 3.2 & 3 & 3 & 3 \end{bmatrix}$$

Order g=5, that is, e=1,2,3,4,5. There were five evaluation gray types. The corresponding gray numbers and whiten weight functions were as follows.

The first gray type "best" (e=1). The gray number $\otimes_1 \in [5,\infty)$, where whiten weight function was f1. The second gray type "good" (e=2). The gray number $\otimes_2 \in [0,4,8]$, where whiten weight function was f2. The third gray type "fair" (e=3). The gray number $\otimes_3 \in [0,3,6]$, where whiten weight function was f3. The fourth gray type "bad" (e=4). The gray number $\otimes_4 \in [0,2,4]$, where whiten weight function was f4. The fifth gray type "worst" (e=5). The gray number $\otimes_5 \in [0,1,2]$, where whiten weight function was f5. For evaluation index V_{11}, the gray evaluation index $x_{11e}^{(1)}$ for the e evaluation gray type perceived by tourists in Xi'an City was given as follows.

e=1 $$x_{111}^{(1)} = \sum_{k=1}^{5} f_1(d_{11k}^{(1)}) = f_1(d_{111}^{(1)}) + f_1(d_{112}^{(1)}) + f_1(d_{113}^{(1)}) + f_1(d_{114}^{(1)}) + f_1(d_{115}^{(1)})$$

$$= f_1(4) + f_1(4) + f_1(5) + f_1(5) = 0.8 + 0.8 + 0.86 + 1 + 1 = 4.46$$

Alike, e=2 $x_{112}^{(1)} = 4.425$ e=3 $x_{113}^{(1)} = 2.567$ e=4 $x_{114}^{(1)} = 0$ e=5 $x_{115}^{(1)} = 0$

For evaluation index V_{11}, the total gray evaluation index $x_{11}^{(1)}$ for each evaluation gray type perceived by tourists in Xi'an City was given as follows.

$$x_{11}^{(1)} = \sum_{e=1}^{5} x_{11e}^{(1)} = x_{111}^{(1)} + x_{112}^{(1)} + x_{113}^{(1)} + x_{114}^{(1)} + x_{115}^{(1)} = 11.452$$

For evaluation index V_{11}, the gray evaluation weight vector $r_{11}^{(1)}$ for the e evaluation gray type perceived by tourists in Xi'an City was given as follows.

$$r_{11}^{(1)} = (r_{111}^{(1)}, r_{112}^{(1)}, r_{113}^{(1)}, r_{114}^{(1)}, r_{115}^{(1)}) = (0.3895, 0.3864, 0.2242, 0, 0,)$$

Alike, it could be calculated that $r_{12}^{(1)}$、$r_{13}^{(1)}$、$r_{21}^{(1)}$、$r_{22}^{(1)}$、$r_{23}^{(1)}$、$r_{24}^{(1)}$、$r_{25}^{(1)}$、$r_{27}^{(1)}$

For V_i perceived by tourists in Xi'an City, the gray evaluation weight matrix

$R_1^{(1)}$ and $R_2^{(1)}$ for each evaluation type belong to index V_{1j}(j=1, 2,3) and V_{2j}(j=1, 2, 3, 4, 5, 6, 7).

$$R_1^{(1)} = \begin{bmatrix} r_{11}^{(1)} \\ r_{12}^{(1)} \\ r_{13}^{(1)} \end{bmatrix} = \begin{bmatrix} 0.3895 & 0.3864 & 0.2242 & 0 & 0 \\ 0.3270 & 0.4046 & 0.2684 & 0 & 0 \\ 0.3529 & 0.3590 & 0.2521 & 0 & 0 \end{bmatrix}$$

$$R_2^{(1)} = \begin{bmatrix} r_{21}^{(1)} \\ r_{22}^{(1)} \\ r_{23}^{(1)} \\ r_{24}^{(1)} \\ r_{25}^{(1)} \\ r_{26}^{(1)} \\ r_{27}^{(1)} \end{bmatrix} = \begin{bmatrix} 0.4619 & 0.3653 & 0.1728 & 0 & 0 \\ 0.2566 & 0.3207 & 0.3183 & 0.1044 & 0 \\ 0.314 & 0.3884 & 0.2776 & 0.02 & 0 \\ 0.3599 & 0.3866 & 0.2450 & 0.008 & 0 \\ 0.4727 & 0.3621 & 0.1652 & 0 & 0 \\ 0.2522 & 0.3115 & 0.3214 & 0.115 & 0 \\ 0.2588 & 0.3123 & 0.3167 & 0.1122 & 0 \end{bmatrix}$$

After V1 and V2 perceived by tourists in Xi'an City were synthetically evaluated, the synthetic results $B_1^{(1)}$ and $B_2^{(1)}$ were given as follows.

$$B_1^{(1)} = A_1 \times R_1^{(1)} = (0.3562,0.3953,0.2484,0,0)$$

$$B_2^{(1)} = A_2 \times R_2^{(1)} = (0.3529,0.3515,0.25,0.0456,0)$$

According to $B_1^{(1)}$ and $B_2^{(1)}$, the total gray evaluation weight matrix $R^{(1)}$ for tourist perception in Xi'an City could be given as follows.

$$R^{(1)} = \begin{bmatrix} B_1^{(1)} \\ B_2^{(1)} \end{bmatrix} = \begin{bmatrix} 0.3562 & 0.3953 & 0.2484 & 0 & 0 \\ 0.3529 & 0.3515 & 0.25 & 0.0456 & 0 \end{bmatrix}$$

After U was synthetically evaluated for tourist perception in Xi'an City, the synthetic evaluation result $B^{(1)}$ could be given as follows.

$$B^{(1)} = A \times R^{(1)} = (0.3545,0.3716,0.2493,0.0246,0)$$

The grading value vector for each evaluation gray type was C=(5, 4, 3, 2, 1). The synthetic value of $W^{(Xi'an)}$ for tourist perception in Xi'an City was as follows.

$$W^{(Xi'an)} = B^{(1)} \times C^T = (0.3545, 0.3716, 0.2493, 0.0246, 0)(5,4,3,2,1)^T = 4.056$$

Alike, $W^{(Lintong)} = 4.037$; $W^{(Xianyang)} = 3.833$; $W^{(Changan)} = 3.798$; $W^{(Gaoling)} = 3.497$.

The order of the synthetic evaluation of tourist perception for the five tourist destinations was as follows:

$$W^{(Xi'an)} > W^{(Lintong)} > W^{(Xianyang)} > W^{(Changan)} > W^{(Gaoling)}$$

5. STUDY RESULT

According to multi-level gray evaluation, the above five tourism destinations could be perceived by tourists as the following three types.

The first perceived area: Xi'anand Lingtong. As international tourist destinations, the attractions in Xi'an and Mound of Qing Emperor, Museum of Military Tomb Figure, Huaqing Pond, Li Mountains, Semi-slope Relic Museum are marvelous tourist resources, which were the key and soul part in grand-Xi'an Tourist Circle. There are advantages such as good tourist environment, high brand, complete fundamentals of transportation and accommodation, good valuable degree and admirable evaluation by travelers. The disadvantages were insufficient supplement of tourist products with recreation and attendance.

The second perceived area: Xianyang and Changan. As regional tourist destination, Xianyang and Changan were compactness radiation regions by grand Xi'an tourism areas. Although the scales and brand as well as total environment in Changan were inferior to those in Xi'an and Lingtong, there were mutual complementary advantages to those of Xi'an. Taking mountainous marvelous scenery in Cuihua Mountain, Wild Three Garden, Ancient Capital Relics in Western Zhou Dynasty and Religious Temples as special tourist resources. The disadvantages in Changan were needed to suitably expand the scales of tourist capacity. The tourist management and tourist service as well as tourist receptions still need to be improved.

The third perceived area: Gaoling. As local tourist destination, Gaoling was

radiation impact region in grand-Xi'an tourism areas, where the converge of Jing River and Wei River formed the extravagant spectacle with "distinguish from Jing to Wei'. Gaoling was also the food production area and fruit plantation area in the plain which was the complementary and extensions of tourist products in grand-Xi'an. Comparatively, the evaluations on the total environment, tourist product attractions and valuable degrees were not high by travelers, which meant that the tourist receptions such as accommodation and meal should be improved urgently.

The corresponding research of evaluation on tourist destinations by Evens (1989) and Core et al. (2002) indicated that the evaluation results by specialists and by travelers had comparatively high consistency totally. Therefore, so as to test the dependability of multi-level gray evaluation by tourist perceptions, the evaluation results by specialists on thetourist perceptions in the above five tourist destination were basically consistent with the above evaluation results. Besides, the level classification results about tourist perceptions had been matched with those such as level division, marketing and value in regional structures of tourist destinations in "Master Planning of Tourist Development in Grand-Xi'an" (2001-2020). It was illustrated that the method of multi-level gray evaluation was scientific and operational to some degree, which could be used as references for tourist perceptions in tourist destinations.

6. CONCLUSION

It was initial trial to evaluate tourist perceptions by the method of multi-level gray evaluation. The problems such as incomplete and inexact information in the tourist perception evaluations had been effectively solved by the combination of level analysis and gray systematic theory. The result was objective and convincing according to the case study in the five tourism destinations in grand-Xi'an tourist regions. Totally, the theory of study method was clear, simply calculated with small survey samples, whichcould be supply a beneficial way for scientific and standard tourist perceptions. However, there were still some places need to be improved such as the selections and completions of evaluation index systems and suitable sample numbers.

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