Research Article

Analytic Hierarchy Process and Its Application in Rural Tourism Service Performance Evaluation

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In contemporary China, tourism is being upgraded to a modern service industry and strategic pillar industry. With the rapid development of modern information and communication technology and the continuous refinement of tourism market demand, tourism has entered a new era of smart tourism. Information runs through the whole process of tourism activities and is the key to determine the quality of tourism. Tourism public service is a very important basic support for tourism activities. It is of great significance to meet the diversified needs of tourists and optimize various services and government management functions. Based on the analysis of the connotation of tourism supply chain performance evaluation, this paper constructs a tourism supply chain performance evaluation index system and performance evaluation model suitable for analytic hierarchy process and studies the product price, production capacity, credit, complaint rate, and management level of its upstream tourism supply enterprises. To test the effectiveness of AHP on tourism supply chain performance evaluation, the comprehensive evaluation results and relevant suggestions for improving performance are obtained, which also proves the extensibility of the performance evaluation index system and provides an effective method for improving the performance of each link of China’s tourism industry and tourism service quality.

1. Introduction

In recent years, driven by information technology, China’s economy is developing rapidly, per capita income is increasing, and people’s demand for spiritual culture is getting higher and higher. Tourism has become an important way for mass leisure and entertainment [1]. According to the statistical report, at the beginning of 2012, there were 13,513 star-rated hotels, 23,690 travel agencies, 56,000 tourist buses, and more than 20,000 tourist attractions, driving more than 13 million people to directly engage in tourism employment. However, there is a huge potential for development. At the present stage, many problems have been exposed in all aspects of tourism industry. Therefore, it is urgent to cooperate and coordinate with many enterprises in the service supply chain to establish an efficient tourism service performance evaluation system, so as to timely meet the diversified and personalized needs of tourists and promote the sustainable growth of tourism consumption. Tourism industry can be studied by the theory of service supply chain management [2–4].

With the arrival of popular tourism, competition for tourists is increasingly fierce among tourism enterprises. Facing the personalized needs of tourists, tourism enterprises are facing the pressure of improving the quality of tourism services and reducing the cost of tourism products [5]. The competition between each other is also transformed from the original competition among individual tourism enterprises. Therefore, we should not only think about the development of enterprises [6] but also the influence of the impact of the development of the whole supply chain on tourism supply chain performance, which can make tourism enterprises to better grasp the operation of the supply chain system and improve its ability to continuously improve and tourism large and complex system [7–9].

At present, the competition among tourism enterprises is gradually changing to the competition between tourism supply chain and tourism supply chain [10]. The performance of tourism supply chain will become the key to win in the competition and also a basic means to judge
whether it is effective to the evaluation of tourism supply chain. Tourism supply chain performance evaluation of the premise condition is necessary to define the connotation of tourism supply chain, the current academic circles of tourism supply chain performance evaluation did not give a true definition, but for the definition of supply chain performance evaluation is more, such as Jia-Zhen Huo [5] for integrated supply chain performance from the perspective of value chain are defined, and focuses on the process performance [11, 12]. That is, to create value through production operation information development of tourist services and tourism marketing and other activities, tourism supply chain performance evaluation should be closely around the supply chain objectives. In its business process, it analyzes and evaluates the overall operation situation of each node enterprise in the tourism supply chain and the business relationship between each node enterprise in all aspects. The performance evaluation indicators of the tourism supply chain generally take nonfinancial indicators as the main aspect [13]. It includes a series of operational relationship evaluation indexes which can reflect the dynamic operation of the tourism supply chain and the upstream and downstream node enterprises [14–16].

Traditional indicators cannot adapt to the current tourism supply chain management, only to establish a set of systematic performance, evaluation indicators of tourism supply chain can make the effective operation of tourism supply chain sustainable. Specifically, the tourism supply chain performance evaluation can adjust and improve the business process and operation state of the tourism supply chain and can also make the decision makers of the tourism supply chain pay attention to its advantages and disadvantages [17–19].

At present, supply chain performance evaluation indicators are generally set for manufacturing or retail, measuring supply chain performance including delivery, total logistics management cost, cash flow turnover time, and asset turnover rate and other 11 evaluation indicators [20]. Considering the general characteristics of tourism supply chain, the tourism performance evaluation index is proposed based on its overall performance and the impact of tourism service process on environment. By the end of 2014, there were 1.9 million rural families and 100,000 rural tourism villages in China. The total annual operating income reached 320 billion yuan, up to 15% year on year, and the annual reception of tourists reached 1.2 billion person-times, about 1/3 of the total domestic tourism reception, a large number of tourists to the public transport services to bring greater pressure. With the increase of per capita car ownership, self-driving travel has become the choice of more and more people. With the increasing proportion of self-driving tourists, the demand for supporting public transport services is increasing, which requires a more reasonable transport service supply structure. Thus, higher requirements are put forward for the construction of parking spaces in rural tourist spots, road construction, traffic indication system construction and self-driving service point construction, etc., and there is a greater demand for the construction of rural tourist special lines and other public transport systems [21, 22].

Facing the increasing demand of tourists for public transport service and the correctness of investment decisions of public transport service in rural tourism spots, it is scientifically feasible to construct a performance evaluation model of public transport service and use to guide the supply of rural tourism public transport service. At present, China’s rural tourism industry is in an important period of transformation and upgrading. Smart tourism not only improves the development of tourism from the aspects of service and management but also an urgent need for the successful regional tourism. Tourism public service-based support is very important in tourism activities, and evaluation of rural tourism is an important index of public service. In order to form an efficient, honest, perfect, and all-round public service network, providing a platform and service support for the development of rural tourism performance evaluation, therefore, the research of this topic not only has important theoretical significance but also has practical application value. Specific performance is in the following three aspects:

1. To provide theoretical support for the construction of evaluation platform for rural tourism services: The construction of smart tourism public service platform is bound to need the support of theory. From the current situation of smart tourism construction in China, practice precedes theory, and the lag of theory is obviously not conducive to the development of tourism services. Therefore, this study will make a breakthrough in theory and form a sound public service system and evaluation system of smart tourism, thus providing strong theoretical guidance for the construction of tourism public service platform and laying a foundation for further research in this field.

2. To provide a basis for government decision-making: The development of tourism is in the forefront of the country, but in the context of smart tourism, rural tourism public service construction. There are still many problems; traditional public service construction has been unable to meet the development needs of modern tourism, the development of wisdom. The study of tourism public service evaluation can not only provide the basis for the government to make the decision of realizing the integration and sharing of tourism resources in the whole province but can also play a promoting role in promoting government tourism intelligent management and intelligent service level.

3. Provide technical support for the development of smart tourism public service platform: In this study, the rural tourism public service platform is analyzed and designed, and the theory is really applied to practice. Feasible construction
implementation plan realizes real-time sharing of tourism information resources and avoids “information island,” for tourists. It provides one-stop all-round tourism service and provides certain technical support for the performance evaluation of smart tourism public service. The layout of this paper is as follows: Section 2 gives the related work; Section 3 is the rural tourism public service performance evaluation by AHP. The experimental results and analysis are given in Section 4. Finally, the conclusions are shown in Section 5.

2. Related Work

Francesco et al. [23] studied the tourism recommendation system. Kelliher et al. [24] proposed a new method to achieve tourism marketing strategy for Turkish travel agencies based on recommendation tools, pointing out that recommendation tools are a common model, the example. An intelligent travel plan recommendation system is developed by inference algorithm, which enables new users to make optimal travel plans based on previous practical cases. Garrigos-Simon et al. [25] pointed out that intelligent system is different from the intelligence system; there are two factors of the behavior to evaluate from the response of the environment.

Generally speaking, advanced tourism countries such as Europe, Singapore, and South Korea have relatively perfect public service system construction and a higher degree of modernization. At the same time, the government has provided huge support in the investment of tourism public service infrastructure. These countries have a relatively perfect tourism public service system, practical research of tourism public service. Through field investigation of communities in northern Canada, Cirillo et al. [26] pointed out the role in ecotourism.

Hong et al. [27] suggested to strengthen government investment, by adjusting the project structure and regional structure, promote investment in infrastructure construction in poor rural areas, and expand the source of funds, and effectively improve the transport facilities in rural areas in phase. Zhang et al. [28] explored the optimization of rural transportation based on reality. Considering that the actual demand of public transportation for tourism in rural areas is relatively low and the destinations of residents in rural communities are different, fixed bus operation is not a wise choice in this case. Thus, a more flexible transport mode, namely, DAR system based on mixed integer programming, is proposed. Kristjánsdóttir et al. [29] believed that the performance evaluation of rural transportation projects is a relatively weak link, and there are often many uncertain factors and high evaluation costs in the existing evaluation. Therefore, the author analyzed the project effect of capital management, ecological environmental impacts, and social and economic benefits. This paper constructs the corresponding evaluation system and evaluation method and carries on the empirical analysis to the rural transportation project of Zhejiang Province. Ristić et al. [30] conducted special research on public infrastructure such as transportation system.

Analytic hierarchy process (AHP) is a common evaluation method that combines qualitative and quantitative methods. Petrova-Antonova et al. [31] comprehensively evaluated the performance level and differences of the five blessings mode of rural tourism by using the AHP, effectively understood the benefits of various service modes, and provided a basis for the study on the rationality of passenger transportation structure. Zhao et al. [32] evaluated the current tourism public service evaluation from five aspects including operation organization and social and economic benefits of safe investment capital by using the analytic hierarchy process and came to the conclusion that the operation mode of bundled area of rural passenger transport was more suitable for the development and management of rural passenger transport. Tien et al. [33] evaluated the performance of rural tourism projects by using analytic hierarchy process and found that the performance of rural transportation projects was good. Petrović et al. [34] put forward the performance evaluation method of logistics service supply chain based on grey analytic hierarchy process and conducted an empirical study based on the integration of automobile logistics supply chain in Chongqing [1]. In the tourism service supply chain model, hotels, shopping facilities, entertainment facilities, passenger transport centers, and scenic spots are the suppliers of products and services. Tourists are demanders and consumers of products and services, including individual travelers and groups. With the improvement of transportation conditions, and the strong support from government departments, tourism industry has become a driving force and an advantageous industry to promote the transformation of regional economic development mode [2].

3. Rural Tourism Public Service Performance Evaluation by AHP

3.1. Structure of Rural Tourism Public Service Performance Evaluation System. The fuzzy analytic hierarchy process (FAHP) and AHP are a systematic analysis method combining qualitative and quantitative methods proposed in 1970s. This method provides a basis for quantitative evaluation index and selection of optimal scheme and has been widely used [5]. The whole system of the method is given in Figure 1.

From Figure 1, we know that the proposed system mainly includes the following four main parts: (1) to determine the key factors of each service, (2) to assign the priority (weight) of factors to each service evaluation factor, (3) to determine the performance evaluation calculation scheme of public services of each tourist attraction, and (4) to generate an ecotourism suitability evaluation result.

3.2. FAHP Algorithm. In FAHP, the importance of one factor to another factor can be expressed quantitatively. If the factor has the following properties, the fuzzy judgment matrix $A$ can be obtained:
For practical problems, the pair-wise comparison judgment matrix on the same factor set $X$ is usually given by multiple experts:

$$A_k = (a_{ij}^{(k)})_{n \times n} \quad (k = 1, 2, \ldots, m). \quad (6)$$

They are all fuzzy complementary judgment matrices, so the sets of weight sets can be obtained, respectively,

$$W^{(k)} = (w_1^{(k)}, w_2^{(k)}, \ldots, w_n^{(k)}) \quad (k = 1, 2, \ldots, m). \quad (7)$$

Then, the consistency test of fuzzy complementary judgment matrix should be done in the following two aspects:

$$I(A_k, W^{(k)}) \leq A, \quad k = 1, 2, \ldots, m, \quad (8)$$

$$I(A_k, A_l) \leq A, l \neq k; \quad k, l = 1, 2, \ldots, m. \quad (9)$$

It can be proved that when fuzzy complementary judgment matrix is uniformly acceptable,

$$W = (W_1, W_2, \ldots, W_n). \quad (10)$$

where

$$W_i = \frac{1}{n} \sum_{k=1}^{n} W_i^{(k)} \quad (i = 1, 2, \ldots, n).$$

From the above analysis, the rural tourism public service platform is built based on cloud computing. The main construction contents of the rural tourism cloud service system include cloud infrastructure, facilities, cloud data center, cloud application center, unified rule collection, unified standard storage, and release on various platforms in accordance with unified exchange standards, so as to finally realize tourism information, intelligent management, and service to maximize the value of intelligent tourism.

The construction of rural tourism cloud service system must achieve data standards, basic information, geographic information, exchange interface, and the unity of the five aspects such as the technology platform, using a centralized, most of the distributed system architecture, build rural tourism information data center of cloud, for the cities and counties (districts), provides centralized upload data entry. At the same time, it still needs to establish data exchange standard provincial tourism bureau and provide exchange interface to each city and county (district), so that their existing information system can realize data synchronization and exchange with the cloud center; cloud data center includes database cloud, management cloud and support cloud construction, and database cloud mainly includes basic database, business database, service database, and decision database. The performance evaluation framework diagram of rural tourism public service proposed in this paper is shown in Figure 2 [11]. From the figure, we know that there are 4 main parts in Figure 2: application, access, cloud data, and infrastructure, the relationship between them is mutually reinforcing.

\[ \text{Figure 1: Structure of the proposed FAHP method.} \]

\[ a_{ii} = 0.5, \quad i = 1, 2, \ldots, n, \]

\[ a_{ij} + a_{ji} = 1, \quad i, j = 1, 2, \ldots, n, \quad (1) \]

where $a_{ij}, a_{ji}$ are the elements of matrix $A$, and $a_{ii}$ are the diagonal elements.

According to the above digital scale, factors $A_1, A_2$, and $A_N$ are compared with each other to obtain the following fuzzy complementary judgment matrix:

\[ A = \begin{bmatrix}
  a_{11} & a_{12} & \cdots & a_{1n} \\
  a_{21} & a_{22} & \cdots & a_{2n} \\
  \vdots & \vdots & \ddots & \vdots \\
  a_{n1} & a_{n2} & \cdots & a_{nn}
\end{bmatrix}. \quad (2) \]

This paper deduces a general formula for solving the weight of fuzzy complementary judgment matrix as follows:

\[ W_i = \frac{\sum_{j=1}^{n} a_{ij} + n/2 - 1}{n(n - 1)}. \quad (3) \]

The method of using the compatibility of fuzzy judgment matrix to test its consistency principle is deduced

\[ I(A, B) = \frac{1}{n} \sum_{j=1}^{n} \sum_{i=1}^{n} a_{ij} + b_{ij} - 1. \quad (4) \]

It is called the $n$-order matrix

\[ W^* = (W_i)_{n \times n}. \quad (5) \]
4. Experimental Results and Analysis

4.1. Introduction to Experimental Environment and Data Set
Taking a village as an example, the author conducted a field questionnaire survey in this village around the Spring Festival of 2018. This survey was conducted by on-site questionnaire distribution and real-time recycling. A total of 200 questionnaires were sent out, 184 were recovered, and 176 were valid, with a recovery rate of 92.0% and an effective rate of 88%. In addition, due to a small number of data samples, the author also collected 180 electronic questionnaires, 167 of which were effective and the effective rate was 92.7%. Therefore, the effective rate of formal research was 343 and the effective rate was 90.2%.

After the preliminary determination of the questionnaire, in order to test the reliability and validity of the questionnaire, the author conducted a predictive test of the questionnaire scale. In the predictive test, the author distributed the questionnaire in a village before the Spring Festival of 2018. A total of 100 questionnaires were collected, of which 84 were valid, with an effective rate of 84%, since the whole questionnaire has the perception of importance and satisfaction of each evaluation index.

4.2. Experimental Results Analysis
Firstly, the comparison of the results of areas of performance appraisal is given in Figure 3. Before this section, the importance perception significance factor was not used, because the evaluation of public health quality of rural tourism perceived by tourists is mainly based on tourist satisfaction. High tourist satisfaction means that tourists have a high evaluation of a public health service quality factor. On the contrary, the evaluation is low, and the importance perception mainly describes the importance of tourists to a certain tourism public health service project, which does not directly affect tourists' satisfaction, and then affects tourists' perception of tourism. Overall evaluation of public health services is performed, so the factor of perceived importance has not been used in previous studies. In this section, the paired T-test is performed on perceived importance and perceived satisfaction. In order to analyze the gap between tourists' expectation of service quality and their actual satisfaction, it is necessary to study tourists' perception of importance and satisfaction.

It can be seen from Figure 4 that the selected village is located at the foot of the Zhaoling Mausoleum of Li Shimin, the world-famous Emperor Taiizong of Tang Dynasty, north of Yanxia Town, Liquan County, Xianyang City, Shaanxi Province. It is 78 kilometers away from Xi’an and about an hour’s drive. It used to be a backwater with barren land and inconvenient transportation. Since the 1970s, the whole village has been united in developing the collective economy and pursuing common prosperity.

In 1993, Yuanjiacun established the agricultural and industrial joint administrative office, under the jurisdiction of 12 subsidiaries, to achieve the transformation of the industrial structure from agriculture to industry. Yuanjiacun in just 10 years to achieve the village of 62 households, 286 people out of poverty to get rich, solve 3000. In 2006, Yuanjiacun focused on creating the tourist destination brand of Guanzhong Impression experience place and innovatively adopted the full-staff and bottom-up scenic spot management model.
In recent years, Yuanjiacun has gradually developed from the original single Guanzhong Impression and experience place with Kangzhuang old street as the main body into a rural tourist resort integrating food, accommodation, travel, shopping, and entertainment, perfectly realizing the third transformation and upgrading from industry to cultural tourism industry.

Figure 3: Areas of performance appraisal: (a) elevation, (b) slope, (c) precipitation, (d) temperature, (e) geology units, (f) landform, (g) distance to river, and (h) distance to stream.

Figure 4: The spatial layout of the village selected for this article.

In recent years, YuanJia village, begin building the snack street in Guanzhong Plain Hui street, Ancestral temple street, college street, bar coffee street, art gallery, and YuanJia ancestral temple. A phantasy thatched cottage. The Guanzhong summer, etc., will the Guanzhong area of folk traditional culture and the combination of modern tourism attracts a steady stream of visitors. Among them, the catering is one of the features of YuanJia village; mesh tofu, yogurt, Laozao, chili vinegar, vermicelli, rapeseed oil, and other stock cooperatives have been formed, which are operated by the subordinate companies of the village committee for the purpose of achieving common prosperity for the villagers. Each household of the snack street cooperative is 3:7,4:6,7:3. According to the income, the profit is divided. The ratio of high income decreases. Low yield ratio increases, but not to earn money and snack street essential category cooperatives subsidies. The results of importance-performance analysis (IPA) are shown in Figure 5.

As shown in Figure 6, according to the t-test results of paired samples, there are 24 indicators with significant differences between importance perception and satisfaction perception, among which 19 are significantly higher in importance perception than in satisfaction perception, and 5 are lower in satisfaction perception than in importance.
The importance of more than half of the 33 indicators is significantly higher than satisfaction, indicating that tourists are not satisfied with the current public services.

The mean difference analysis of importance and sensitivity is shown in Figure 7. According to the analysis of the importance and satisfaction perception mean difference (importance perception average-average satisfaction perception), 24 of the mean difference are positive and that of tourists for YuanJia village rural tourism service quality of public health importance of sensory evaluation is lower than their actual satisfaction for its sensory evaluation, said YuanJia village rural tourism public health service quality. Quantity cannot fully meet the actual quality of health service demand of tourists. That is to say, the quality of these public health services should be improved.

In order to facilitate the analysis of the distribution and characteristics of indicators in each quadrant, the author drew the IPA positioning analysis chart of tourists’ evaluation of public health service quality of rural tourism in YuanJiacun as given in Figure 8. Quadrant 1: there are 13 rural tourism public health service indicators located in this quadrant. According to the interpretation of the principle of IPA, these indicators are not only important for improving tourists’ tourism experience but also Yuanjiacun rural tourism has done relatively well in these aspects, the mean values of satisfaction perception of these rural tourism public health service indicators among surveyed tourists are all lower than the mean values of importance perception, indicating that Yuanjiacun rural tourism destination needs to continuously improve the quality of public health service in these aspects to maintain this advantage. Quadrant 2: there are 6 rural tourism public health service indicators located in this quadrant, the mean values of the perceived importance of these rural tourism public health service indicators are all higher than the perceived satisfaction of the surveyed tourists. According to the interpretation of IPA principle, these indicators of tourism public health service quality in the view of tourists need to increase investment and focus on improvement. Quadrant 3:
there are 9 rural tourism public health service indicators located in this quadrant. Including 2, 3 June, 30 indicators project satisfaction perception average higher than the average importance perception, 16, 17, 14, 31, 32 indicators project importance perception average below average satisfaction perception, although these indicators in the aspect of the present stage of tourists perception belongs to low priority. But, the rural tourism public health service of Yuanjiacun still needs to be improved in these aspects. Quadrant 4: it can be seen from the five quantitative indexes in this quadrant that tourists have higher satisfaction with public health service projects.

5. Conclusions

This article is based on tourists angle to discuss the rural tourism public health service quality evaluation scale and model building in Xianyang YuanJia village as an example, through field investigation data analysis, validation, and improve the rural tourism public health service quality evaluation scale, and the model of the reliability of the research lies in the following three aspects. (1) A relative effective evaluation scale of rural tourism public health service quality was designed. (2) The evaluation model of rural tourism public health service quality is constructed. (3) The
countermeasures and suggestions to improve the quality of rural tourism public health service are put forward. Although this paper has carried out an in-depth analysis on the evaluation of rural tourism public health service quality, due to the limitations of personal knowledge and research ability and economic conditions, this study still has certain limitations. In the future, it can be further studied from the following aspects to deepen the topic selection of this study.

Data Availability

The data used to support the findings of this study are available from the author upon request.

Conflicts of Interest

The author declares no conflicts of interest or personal relationships that could have appeared to influence the work reported in this paper.

References


