

AHP (Analytic Hierarchy Process) and Computer Analysis Software Used in Tourism Safety

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Abstract—With the improvement of the people's leisure means, the development of tourism is becoming increasingly quick. Tourism security is the most crucial factor in the development of tourism industry. Experts have been looking for travel safety evaluation methods, however the results are unsatisfactory. Combining computer software and data analysis software (AHP analysis) together, and thereby evaluating the tourism safety, we have achieved some satisfactory results. First of all, we collected the data through questionnaire survey. Then we used analytic hierarchy process (AHP) theory and computer software to analyze these data. The experiment proved that this evaluation method has good popularization value.

Index Terms—tourism security, safety weight, analytic hierarchy process (AHP), Expert - Choice 2000 AHP analysis software

I. INTRODUCTION

The human society has stepped into the period of 'risk society'. In order to ensure the healthy development of nations, region, and industry, many industries, at home and abroad, have applied risk management, a new perspective, to study the traditional security and disaster-managed problems. At present, in the industry and other kinds of security and disaster-researches at home and abroad, the risk assessment theory for analyzing problems has become a new perspective and new trend. Full attention is paid to researches and practice of risk assessment by UN Environmental Disaster Reduction (ISDR), the Risk Management Board (IRGC), the organization for Economic Co-operation and Development (OECD), 'integrity network'(Trustnet) and other European and international institutions, such as Britain's National Consumer Council and other state institutions. The concept of risk assessment, including its process and model, widely involved in research. In China, "the national medium and long-term science and

technology development plan" has taken the risk management work as important issues of China science and technology development within 20 years. Founded soon the China National Committee Human Factors Of International Global Environmental Change Plan (CNC - IHDWRG) is focused on the new study about the comprehensive risk assessment. Looking from the booming risk assessment research at home and abroad,

Risk assessment theory help decision makers choose the optimal technology and policy in the safety management. Tourism is currently the world's largest industries and the China's "sunrise industry", and the risks of tourism destination are the radical barrier factors of the development of tourism in our country, it's also one of the key areas in the research of domestic tourism in recent years. The safety problems of visitors are concerned by people. [1] -[3]

In recent years, the increasing popularity and frequent accidents in adventure tourism, have caused more and more attention among the Government departments and academia. In view of this, based on the AHP framework of risk assessment, the paper introduces risk assessment theory into the assessment and management of tourist-destination-safety risks, including how to deal with the safety-risk-assessment of the destination. From the perspective of tourism subject, Hall states, tourism security is the key factors to get rid of physical diseases, be concerned about health, and all kinds of potential political crime violence of and danger. It is a key factor for a tourist destination to enhance its attractiveness. Security is the rejection of risk. Tsaur defines tourism risk as the possibility for tourists suffering from all sorts of misfortune during the journey or in the tourist destination. Oliver points out that it would be identified as "not satisfied", if a product or service can not meet tourists' expectations, whether it is

caused by internal or external reason. Tourists as a risk or unsafe factor is they can't control factors. [4] -[5] Tourism unsafe factors is a major fetter, which restrict the development of the tourism market. Studies of tourist motivation shows that tourists have to seek security, the tourists in addition to publicly express fear of travel risk, many people still lack of interest in tourism as the tour safety issues. This kind of view has been verified by many examples, such as the terrorist-attacks in the Middle East, the spread of disease in African countries, and political instability, environmental pollution and health condition in India, etc. Thus it has become an important subject for studying, including how to guard against and evade risk in the rapid development of outbound tourism.

Theory of both ends tells us that the existence of tourism risks has its inevitability. However, it will largely improve the safety factors in the tourism activities, if we have timely and accurate information transmission, comprehensive tourism planning and policy adjustments. It has practical significance to research that what important position of different tourism safety factors is in the eyes of tourists. It can reflect the demand of tourism consumers and their understanding. it is the embodiment of marketing concept, and is also one of the basic issue in tourism safety study and evaluation of tourism safety .About all the weights allocation of factors, usually we give weight with experience directly, but it is difficult to achieve the objective precisely. On the basis the complexity and uncertainty of risk assessment and by using the gray system theory and risk assessment theory , we set up the evaluation patter of safety risk gray correlation in tourist destination, after modifying the Analytic Hierarchy Process (AHP) .[6] -[9]

In this article, with the help of questionnaire, we use (Analysis Hierarchy Process, the AHP) principle to analysis tourists' consideration of safety factors during the journey or in the destination, and its importance. AHP method is a multi-objective decision analysis method, combines qualitative and quantitative analysis. It was proposed by Saaty, the United States Operational research, in the early 1970s. The characteristics of this method is that it can simulate human beings' process of thinking. Basing on in-depth analysis of the influence of complex decision and its inherent relationship, it produces the process of thinking mathematical by using a little quantitative information. So as to provide easy and convenient decision method of multiple targets, criteria or nonstructural characteristics of complex problems it has characteristics of clear, popular, and highly systemic, etc. Authors decompose the problem into component factors by using AHP method, and then compose these factors into class hierarchy according to the dominant relationship. Lastly, we determine the levels of the factors in the importance or weight in relations after pairwise comparison and solution of the judgment matrix.

II. TOURISM SAFETY FACTORS IN THE AHP MODEL

Throughout the research literature of the tourism safety consumption behavior, and its variety classification

of tourist safety or risk , Jinfu Zhang and others think that according to the characteristics of operational link of tourism and its activities, tourism security can be divided into six categories: food security, accommodation security, traffic safety, sightseeing security, shopping security, and entertainment security. Roehl and Fesenmaier divide risks into seven classes: equipment risk, economic risk, physical risk, psychological risk, social risk and time risk. Bettman simply classifies risk as inherent risk and operation risk. Developing from the predecessors' point of view, Tsaur scholars divide risks into seven classes : traffic risk, legal risk and risk of social security, health, housing, weather risk, risk of scenic spots, and medical risk.

TABLE.I.A CONCEPTUAL MODEL OF THE TOURISM SAFETY ANALYSIS

Target	Criteria layer B	Attribute layer C
layer A		
	Traffic safety B ₁	Transportation safety C ₁₁ Traffic control safety C ₁₂ Convenience of communication C ₁₃
	sanitary safety B ₂	The possibility of infection C ₂₁ Food hygiene C ₂₂
Travel	Political security law and social order B ₃	Political stability C ₃₁ The possibility of illegal and criminal behavior C ₃₂
	safety	The friendly attitude of local residents to the tourists C ₃₃
	medical safety B ₄	Emergency rescue C ₄₁ The perfect degree of the medical service system C ₄₂
	Destination safety B ₅	Destination facilities safety C ₅₁ The quality of staff and management quality C ₅₂
	The weather's security situation B ₆	Local weather changes C ₆₁ The possibility of natural disasters C ₆₂
	Hotel security B ₇	The hotel fire control facilities C ₇₁ The hotel security system C ₇₂

The study build the AHP model as the basic framework, referring to Tsaur’s method of tourism risk factors. The conceptual model divides the hierarchical structure into three levels (table 1). The first layer, as the target one, analyzes the importance of tourism safety factor level, offering support to assessment and decision-making of tourism safety. Use A for travel safety goal layer. The second layer, as the criterion layer, is the middle tier of hierarchical structure model. It is combined with the seven elements of traffic safety, health safety, political law and order of social security, housing security, medical security, the safety of scenic spots, and the weather security .we used B as criterion layer. The third layer is the attribute layer, including a total of 16 items. It is decomposition and specific connotation of the criterion layer. It is attribute layer, also requires the evaluators answer and evaluate directly. We Use C for the elements in turn.[10] -[13]

The objectivity, representativeness and universality of the results should be considered when evaluate the tourist safety. Normally, the manager of the outbound tourism of travel agency understand his/her serviced object's psychology and perception, because of the directly contraction with China outbound tourists at work. This collection of survey data selects 40 senior tourism managers from 25 provinces and autonomous regions, who fill in the sample. Respondents on average professional working fixed number of year is 6 years. 40 questionnaires have been issued, and all of them were collected back. The respond rate is 100 percent.

3.1 The Comparison between the Two Judgments

Pairwise comparison analysis is the basic execute method of AHP. This study uses this method, asked people to fill in the questionnaire for the compare in 16 of the attribute layer elements, and compared the importance and degree of the factors. The results are shown in table 2.

III. DATA COLLECTION AND ANALYSIS

TABLE.2.
THE RESULT OF THE COMPARISON

The value of relative importance	meaning	explain
1	Just as important as	A Just as important as B
3	Slightly more important.	A is somewhat important than B
5	Obvious important.	A is more important than B
7	very important.	Strong important A than B
9	extremely important	A is extremely important than B
2,4,6,8	Between 1,3,5,7,9 evaluation value respectively	

3.2 Consistency Check

The consistency check must be carried out after comparing two, before the analysis, the judgment. If a person wants to rank apples, oranges, bananas, it would be all by his/her fond. For apples and oranges, he/she prefers to eat apple; for the orange and banana, he like oranges; For apple and banana, he like bananas. It would appear some contradiction and inconsistencies. In the AHP, it is a normal phenomenon. Especially there are larges of comparing elements. Usually it can use CR (Consistency Ratio) to measure the degree of inconsistency. If the CR was less than or equal to 0.1, it is reasonable. If CR was equal to 0, it is the ideal state, namely it’s completely consistent. When CR > 0.1, the model should be revised or rejected. [14] -[16]

3.3 Data Analysis

Traditional AHP analyses, usually use the tedious mathematical model method. On the basis of constructing two comparative judgment-matrix, we use the mathematical method of solving the maximum characteristic roots of judgment matrix and its

characteristic vectors to get the relative weights of various factors. Then we detect the rate of CR consistency, through calculation of the maximum matrix of the matrix characteristic root, which deviating from the n number of elements. And the data processing of this study, with the aid of the advanced AHP "Expert - Choice 2000" computer analysis software, which based on the principle of AHP. The software can help the government and enterprise configure resources, invest project, manage risks, and use in other fields for complex decision-making. It makes decision-making more convenient and scientific. At the same time, the system also has the function of automatically detecting the consistency CR, so that operators are able to identify the effectiveness of the questionnaire.

On operating "the Expert - Choice 2000" system, it should set the option name first. In this study, there are 16 Attribute layer elements: C₁₁, C₁₂, and C₁₃, C₂₁, C₂₂... C₇₂.

3. 3. 1 Evaluating data of single evaluator

In "Expert - Choice 2000", we input two judgments of a questionnaire after determining the target and setting more options. These numbers shall be between 0 and 9

(including 0 and 9).It is shown in figure 1. It can be vividly reflected the ratio through mobile logo block in the application. It can show the importance rate of weight and consistency CR of the 16 elements. There are 8 questionnaires, whose CR is more than 0.1. So there are only 32 real effective questionnaires.

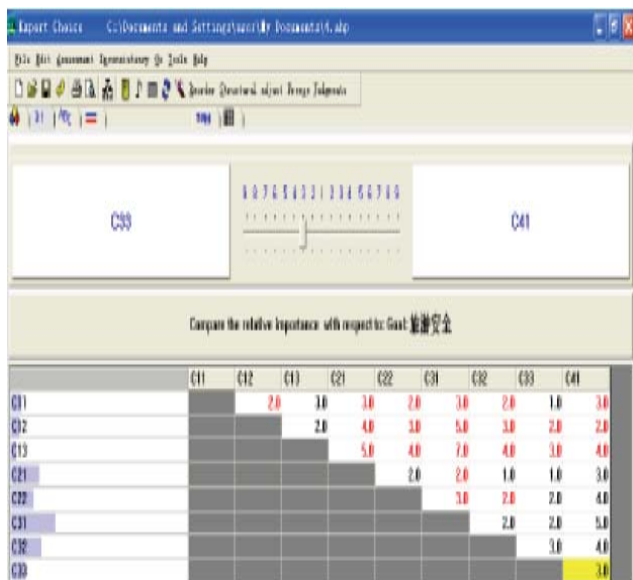


FIGURE 1. TWO THAN TO JUDGE THE DATA INPUT IN THE EXPERT - CHOICE 2000 OPERATING SYSTEM

the scenery security (0.109), the traffic safety (0.107), and last, the weather safety (0.053). The research could

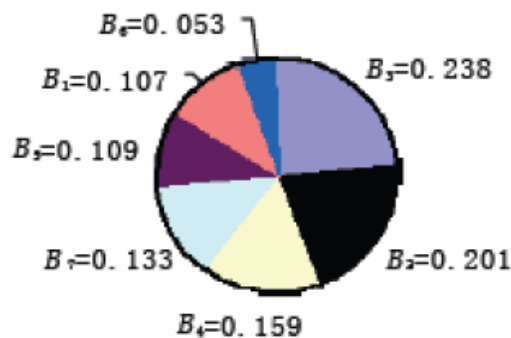
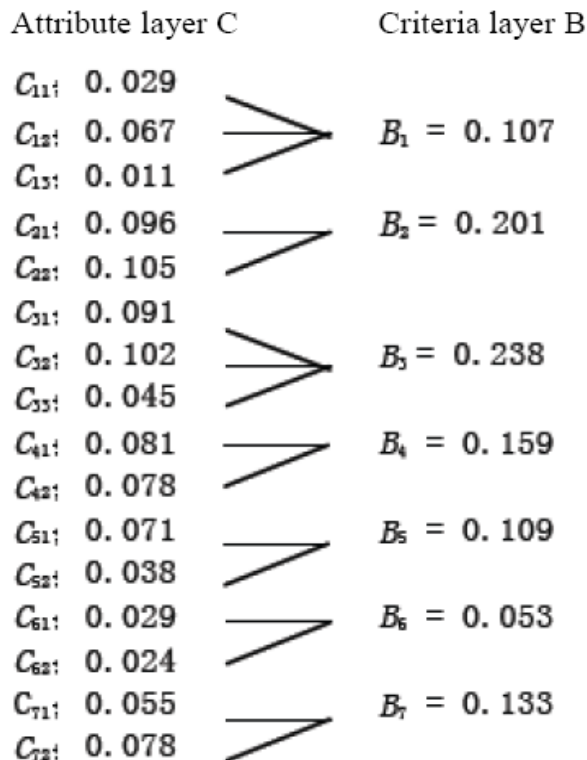


FIGURE.2.

ATTRIBUTE LAYER AND CRITERIAL LAYER

3 3 2 Synthesis assessment of all assessors

Through the analysis of the data of 32 copies of valid questionnaires, the author concluded the Weight value of 32 groups Attribute layer elements

$$i.e. C_{ij}^k (k = 1,2,3,\dots,32)$$

Due to the existing difference of 32 groups assessment data, we calculate the average by the arithmetic average method .

$$c_{ij} = \left(\sum_{k=1}^{32} c_{ij}^k / 32 \right)$$

As shown in figure 2, for each criterion layer factor, their weight values in the target tourist safety can be get by the attribute weighting factors. The security factors of Criterion layer can be seen as a group of vector:

$$W=(B_1, B_2, B_3, B_4, B_5, B_6, B_7)$$

IV. THE CONCLUSION

It can be seen from the above data that Chinese tourists put the political laws and the social order and safety in the first place, during the journey and in the destination (0.238). The health and safety are the second important factor (0.201), followed by the medical treatment (0.159), the accommodation security (0.133),

be of any help on the following aspects of tourism practice

4.1 The tourist-receiving countries or regions, which take China as one of the main tourist market, should pay attention to improving the level of political law, social security, and health. From the perspective of the tourist motives, these are the pulling factors to attract Chinese tourists.

4.2 Due to the different understanding of the Chinese tourists on the importance of the safety factors, the government and relevant departments should consider the corresponding weight values when constructing the

Evaluation System of tourism security situation in order to make the evaluation system stronger and more scientific.

4.3 China's relevant departments shall establish a set of perfect "early warning system for tourism security", which focus on "political warning" and "health warning". In the world today, the outbound tourism alert system in many countries focus on these two aspects specially. So the results of this study also provides theoretical basis for China to establish 'early warning system for tourism security' in line with international standards.

Tourism risk is the tourists' feeling of possible risk during the group tours. The risk of produce is mainly from the tourism service conditions which provided by the tourism itinerary and its destination. The risk of tourism itself, due to varies regional, seasonal, and route factors. But the basic variables which contain roughly the same factors, focus on the accommodation, traffic, public security and other fields. The purpose of establishing the tourist-safety-risks assessment model is to use scientific methods to discuss the risk of tourism destination thereby to take interviewees' ambiguity of the respondents of every tourist destination risk problems into consideration. It uses AHP theory to set up the evaluation mode to assess the risk of tourist destination. It should be considered whether the factor is the time series or not. If it's not, it should make different distributions of the weight.[16]-[19]

Among the booming risk assessment research at home and abroad, risk assessment theory will help decision makers in the security management field to choose optimal technical and policy targeting. Tourism is currently the world's largest industries and China's booming business. Risk issues become the focus.

Accidents often happen with adventure tourism has become increasingly popular in recent years. It also provokes government and academic circles to pay attention to the security risk assessment. This study made a beneficial attempt in this aspect, and achieved satisfactory results. and this study provides a valuable decision-making basis for government and tourism companies.

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