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International Journal of Engineering Business Management

# Prioritizing the Factor Weights Affecting Tourism Performance by FAHP

Regular Paper

Quang Hung Do[1] and Jeng Fung Chen[1,*]

1 Department of Industrial Engineering and Systems Management, Feng Chia University, Taichung, Taiwan
* Corresponding author E-mail: chenjengfung@gmail.com

Received 11 Jun 2013; Accepted 23 Sep 2013

DOI: 10.5772/57141



Abstract The allocation of limited resources to effectively promote tourism is one of the most important issues in the tourism industry, especially in tough economic times. This paper seeks to investigate the relative importance of the key factors affecting tourism performance by applying the fuzzy analytic hierarchy process (FAHP) method. Specifically, the paper identifies the factors and sub-factors of the hierarchical structure from the literature relating to tourism performance. The framework based on the AHP method is then proposed to determine the relative weights of the factors and sub-factors in contributing to tourism performance. An application case related to the Vietnamese context is used to illustrate the proposed framework. The results of this study consolidated the tourism theory and suggested recommendations and solutions for the Vietnamese tourism industry. The proposed framework could be used by a group of decision-makers to achieve a consensus, as well as deal with uncertainty in the decision-making process. The findings of the study may serve as a tool for assistance for planners in improving the efficiency of tourism performance.

Keywords Decision-Making Process, Fuzzy Analytic Hierarchy Process, Tourism Performance

## 1. Introduction

Tourism has become one of the world's largest industries [1]. Even in tough economic times, it has been one of the most successful sectors. As the tourism industry not only creates jobs, attracts foreign investment and promotes sales, it also shifts the workforce from other more unstable sectors to the leisure and hospitality industry [2]. Many nations and regions have turned to tourism as an important element in their economic portfolio. Being a socio-economic element, tourism does not occur randomly. Some nations and regions are more successful than others in attracting tourists by offering activities enjoyed by tourists. In order to have success in an international competitive sector like tourism, it is necessary to identify the key factors affecting tourism performance and have appropriate promotion strategies.

The objective of this study is to identify the relative importance of key influential factors in the tourism industry. Vietnam is used as the subject of this study. The factors contributing to tourism performance efficiency can be identified through a literature investigation and expert interviews. There are several factors that affect tourism, namely, the economy, technology, politics, population and culture. However, because of issues of practicality, the contributing factors mainly derived from Lai and Vinh [3] and expert interviews are used throughout this paper. These factors consist of promotional activities, destination attributes and destination image.

Prioritizing the factors and sub-factors that affect tourism performance efficiency can be viewed as a multiple criteria decision-making (MCDM) problem. Group MCDM is an overlapping field of group decision-making and multiple criteria decision-making. Decision-making is the study of identifying and choosing alternatives based on the judgments of decision-makers. It has been proved that a decision made by a group tends to be more objective and effective than a decision made by an individual. Therefore, group decision-making is an aggregate decision-making process in which individuals' decisions are grouped together to solve a particular problem. A major part of decision-making involves the analysis of a set of alternatives described in terms of evaluative criteria. In order to find the most suitable alternative or determine the relative priority of each alternative, they must be ranked. Solving such problems is the focus of MCDM in decision and information sciences. MCDM is supported by a set of techniques, some of the main ones of which are the analytic hierarchy process (AHP), the technique for order preference by similarity to an ideal solution (TOPSIS), the preference ranking organization method for enrichment evaluation (PROMETHEE), multi-attribute utility analysis (MAUT) and elimination and choice translating reality (ELECTRE). Among these, the AHP approach seems be a very popular method and has been widely applied to deal with various complex decision-making problems. AHP [4] is a powerful management tool that successfully solves many multiple-criteria decision problems. In the pure AHP, the relative importance of decision elements is evaluated from comparison judgments that are represented as crisp values. However, in many cases, the human preferences are uncertain and decision-makers usually feel more confident utilizing linguistic variables rather than expressing their judgments in the form of numeric values. In order to deal with more decision-making problems in real situations, fuzzy set theory [5] was incorporated into the AHP. Being an extension of the AHP, the fuzzy AHP (FAHP) is able to solve the hierarchical fuzzy decision-making problems. Since its appearance, the FAHP method has been widely used by many researchers to solve different decision-making problems in various areas. Mikhailov and Tsvetinov [6] used the FAHP to deal with the uncertainty and imprecision of the service evaluation process. Chan and Kumar [7] presented an extended FAHP approach to select the best supplier in which one must also consider the risk factors. Chang, Wu and Lin [8] applied the FAHP method to construct an expert decision-making process. Celik, Deha and Fahri [9] applied the extended FAHP method to structure a practical decision support system in shipping registry selection. Lee [10] developed an intellectual capital evaluation model based on fuzzy AHP for assessing the performance contribution in a university. Chen and Lee [11] employed the FAHP approach to determine the attribute weights of selecting a professional conference organizer. Apart from the above-mentioned applications, there remain many studies of FAHP for solving other different managerial problems. The great success of the FAHP in published works motivated us to use this method in our research. Specifically, Chang's extent analysis of the FAHP method [12], [13] is utilized to calculate the weights of factors and sub-factors affecting the success of tourism.

In general, the scientific contribution of this paper is related to the new approach applied. This study provides valuable information and knowledge of tourism promotional effectiveness in order to improve tourism performance efficiency. Our study is related to the Vietnamese tourism industry and its context. To the best of our knowledge, very little research has been devoted to the Vietnamese tourism industry; additionally, the FAHP in the present context is applied for the first time in this research. This study is useful, not only to the Vietnamese tourism industry, but also to those tourism managers who have investments in the tourism sector.

The remainder of the paper is organized as follows. The hierarchical structure of the factors affecting tourism performance is presented in Section 2, which is followed in the next section by the introduction of the FAHP and certain related concepts. Section 4 presents the proposed framework to determine the factor weights and a case application. Conclusions are drawn in Section 5.

## 2. The hierarchical structure of the factors and sub-factors

Through a literature review [1], [3], [14], [15], [16] and discussions with experts, a number of factors and sub-factors that are considered to have an influence on tourism performance were determined and adopted. We applied decision systems analysis (DSA) to establish an interview process for experts who were involved in various phases in the decision process. The DSA has the ability to describe configurations as to why and how a decision process occurs. It also represents the flow of thinking, the interactions of experts, decisions, actions, and outcomes of the decision process. In order to form the hierarchical structure, there were three rounds of interviews. Firstly, based on literature reviews, the DSA included a series of preliminary flowcharts of the decision phases and interactions of experts. In the second round of interviews, these flowcharts were shown to experts to deduce additional details of the decision process; hence, corrections and improvements were made. As a result, and after this round, the preliminary flowcharts were more accurate. In the third round of interviews, the flowcharts were shown to other experts who had observed the decision process but had not directly participated in the previous rounds of interviews. After the third round of interviews, the hierarchical structure of the factors and sub-factors that have an influence on tourism performance was derived. In each round of interviews, the expert backgrounds were taken into consideration. Following the process of the DSA from the first round to the third round of interviews, the factors' and sub-factors' selection and the formation of the hierarchical structure were performed. As shown in Figure 1, the hierarchical structure has three levels: objective, factors and sub-factors. The objective is the prioritization of the factors affecting tourism performance. The factors that are considered in the prioritization process are: promotional activities, destination attributes and destination image. The factors are composed of several sub-factors.

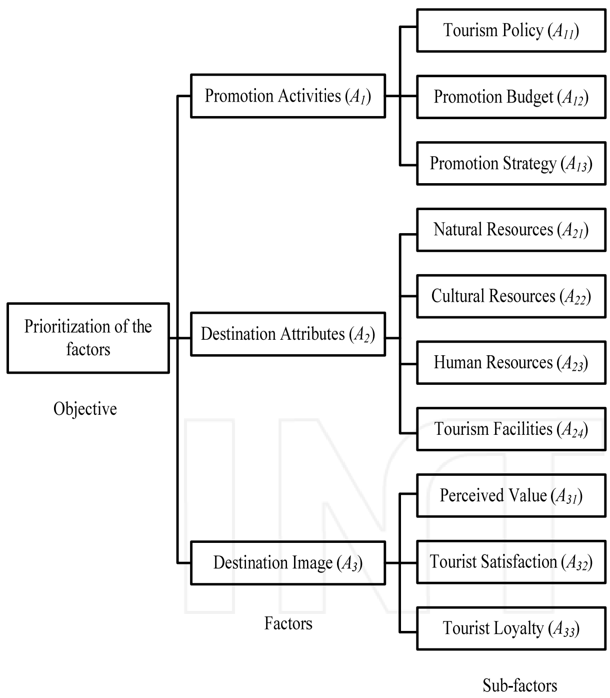


**Figure 1.** The hierarchical structure of tourism performance efficiency.

Promotional activities comprise activities of government aimed at promoting the national tourism industry. The category consists of three sub-factors: tourism policy, promotion budget and promotion strategy. Destination attributes are viewed as the 'pull factors' [14]. The destination attributes can lead a traveller to select one destination over another once the decision to travel has been made. Destination attributes can be subdivided into four sub-factors: natural resources, cultural resources, human resources and tourism facilities. There are several studies [15], [16] that demonstrate that the destination image has a significant effect on a traveller's destination choices. The destination image is split into three sub-factors: perceived value, tourism satisfaction and tourist loyalty. A synopsis of sub-factors with descriptions is presented in Table 1.

| Sub-factor | Description |
|---|---|
| Promotional Activities ($A_1$) | |
| Tourism Policy ($A_{11}$) | A set of regulations, rules, guidelines, etc., that affect tourism development. |
| Promotion Budget ($A_{12}$) | The funds for tourism promotion. |
| Promotion Strategy ($A_{13}$) | The activity of marketing communication with the target audience in various or selected markets. |
| Destination Attributes ($A_2$) | |
| Natural Resources ($A_{21}$) | The environment of the destination, which includes scenery, landscape, climate, physiography and all elements that tourists would like to enjoy and consider important. |
| Cultural Resources ($A_{22}$) | Cultural attractions, such as the history, customs, artwork and architectural features that motivate people to travel. |
| Human Resources ($A_{23}$) | Worker and actions taken in tourism services organizations. |
| Tourism Facilities ($A_{24}$) | The destination's general infrastructure, such as the transportation network, healthcare system and telecommunications. |
| Destination Image ($A_3$) | |
| Perceived Value ($A_{31}$) | The value that is derived from the visitors' judgment as to what is received (benefits) and what is given (costs). |
| Tourist Satisfaction ($A_{32}$) | Tourists' satisfaction with the destination after visiting the area. |
| Tourist Loyalty ($A_{33}$) | The visitor perception of the destination that affects the future re-visitation rate and the willingness to recommend the destination to other people. |

**Table 1.** Factors and sub-factors with descriptions

## 3. Fuzzy Analytic Hierarchy Process (FAHP)

### *3.1 Fuzzy sets and fuzzy numbers*

Fuzzy set theory was first introduced by Zadeh [5] to deal with the uncertainty due to imprecision or vagueness. A fuzzy set $\tilde{A} = \{(x, \mu_{\tilde{A}}(x)) \mid x \in X\}$ is a set of ordered pairs and $X$ is a subset of the real numbers $R$, where $\mu_{\tilde{A}}(x)$ is a membership function that assigns to each object $x$ a grade of membership ranging from zero to one. Since its introduction, fuzzy set theory has been widely applied to address real-world problems in which decision-makers need to analyse and process information that is imprecise. A fuzzy number is a special case of a convex normalized fuzzy set [17]. It is possible to use different fuzzy numbers under various particular situations. Triangular and trapezoidal fuzzy numbers are usually adopted to deal with the vagueness of decisions related to the performance levels of alternative choices with respect to each criterion. When the two most promising values of a trapezoidal fuzzy number are the same number, it becomes a triangular fuzzy number (TFN). This means that a TFN is a special case of a trapezoidal fuzzy number. Because of its intuitive appeal and computational efficiency, the TFN is the most widely used membership function for many applications. TFNs are usually employed to capture the vagueness of the parameters related to the decision-making process. In order to reflect the fuzziness that surrounds decision-makers when they conduct a pairwise comparison matrix, TFN is expressed with boundaries instead of crisp numbers. A TFN, denoted by $\tilde{A}=(l,m,u)$, has the following membership function:

$$\mu_{\tilde{A}}(x)=\begin{cases}(x-l)/(m-l), & l\le x\le m\\ (u-x)/(u-m), & m\le x\le u\\ 0 & otherwise\end{cases} \quad (1)$$

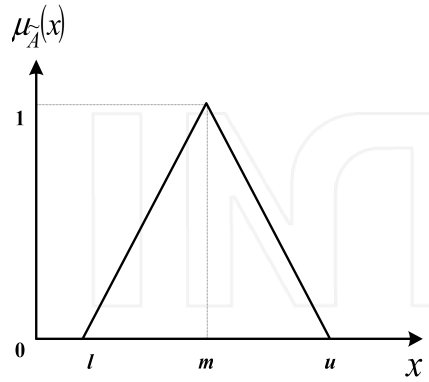


**Figure 2.** A triangular fuzzy number, $\tilde{A}=(l,m,u)$.

A TFN $\tilde{A}$ is shown in Figure 2. The parameter '$m$' is the most promising value. The parameter '$u$' is the largest possible value and the parameter '$l$' is the smallest possible value; they limit the field of possible evaluation. The triplet *(l,m,u)* can be used to describe a fuzzy event.

For the two TFNs $\tilde{A}_1$ and $\tilde{A}_2$, $\tilde{A}_1=(l_1,m_1,u_1)$ and $\tilde{A}_2=(l_2,m_2,u_2)$, and the main operational laws for the two TFN s $\tilde{A}_1$ and $\tilde{A}_2$ are as follows [18]:

$$\begin{aligned}\tilde{A}_1+\tilde{A}_2&=(l_1+l_2,m_1+m_2,u_1+u_2)\\ \tilde{A}_1\otimes\tilde{A}_2&\approx(l_1l_2,m_1m_2,u_1u_2)\\ \lambda\otimes\tilde{A}_1&=(\lambda l_1,\lambda m_1,\lambda u_1),\lambda>0,\lambda\in R\\ \tilde{A}_1^{-1}&\approx(1/u_1,1/m_1,1/l_1)\end{aligned} \quad (2)$$

*3.2 The FAHP method*

In the AHP, the decision-making process uses pairwise comparison judgments and matrix algebra to identify and estimate the relative importance of criteria and alternatives. AHP is a powerful method to solve complex decision problems. However, the pure AHP method has certain shortcomings. In particular, AHP is ineffective when applied to dealing with the ambiguity problem. FAHP, an extension of the AHP model, has been applied to fuzzy decision-making problems. In FAHP, by using fuzzy arithmetic operation laws, the weights of evaluative elements are determined. There are several FAHP methods reported in the literature. The first work of FAHP was proposed by Van Laarhoven and Pedrycz [19], which compared fuzzy ratios described by TFNs. They applied the logarithmic least-square method to derive fuzzy weights and scores. Buckley, Feuring and Hayashi [20], [21] used comparison ratios based on trapezoidal fuzzy numbers to deal with the imprecision in a decision-maker's evaluation. They extended Saaty's AHP and used the geometric mean method to obtain fuzzy weights and scores. Chang [12], [13] proposed a new extended analysis approach based on TFNs for pairwise comparison. Buyukozkan, Kahraman and Ruan [22] made a comparison of the various FAHP methods that have differences in their theoretical structures. In their work, they pointed out the advantages as well as the disadvantages of each method. Since Chang's extent analysis method is similar to conventional AHP and requires low computational capacity in its implementation, many of the recent FAHP applications have utilized this method. This research uses Chang's method to get the weights of factors and sub-factors out of pairwise comparisons of expert opinions.

Let $\tilde{A}=(\tilde{a}_{ij})_{nxm}$ be a fuzzy pairwise comparison matrix, where $\tilde{a}_{ij}=(l_{ij},m_{ij},u_{ij})$. The steps used for the Chang method are as follows:

Initially, the value of the fuzzy synthetic extent with respect to the *i*th object is defined as:

$$S_i=\sum_{j=1}^{m}M_{ij}\otimes\left[\sum_{i=1}^{n}\sum_{j=1}^{m}M_{ij}\right]^{-1} \quad (3)$$

with:

$$\sum_{j=1}^{m} M_{ij} = \left( \sum_{j=1}^{m} l_{ij}, \sum_{j=1}^{m} m_{ij}, \sum_{j=1}^{m} u_{ij} \right), i=1,2,...,n \quad (4)$$

$$\sum_{i=1}^{n}\sum_{j=1}^{m} M_{ij} = \left( \sum_{i=1}^{n}\sum_{j=1}^{m} l_{ij}, \sum_{i=1}^{n}\sum_{j=1}^{m} m_{ij}, \sum_{i=1}^{n}\sum_{j=1}^{m} u_{ij} \right) \quad (5)$$

$$\left[ \sum_{i=1}^{n}\sum_{j=1}^{m} M_{ij} \right]^{-1} = \left( \frac{1}{\sum_{i=1}^{n}\sum_{j=1}^{m} u_{ij}}, \frac{1}{\sum_{i=1}^{n}\sum_{j=1}^{m} m_{ij}}, \frac{1}{\sum_{i=1}^{n}\sum_{j=1}^{m} l_{ij}} \right) \quad (6)$$

Secondly, the values of $S_i$ are compared and the degree of possibility of $S_j = (l_j, m_j, u_j) \geq S_i = (l_i, m_i, u_i)$ is calculated. This can be equivalently expressed as follows:

$$V(S_j \geq S_i) = height(S_i \cap S_j) = \begin{cases} 1, & if \quad m_j \geq m_i \\ 0, & if \quad l_i \geq u_j \\ \frac{l_i - u_j}{(m_j - u_j) - (m_i - l_i)} & otherwise \end{cases} \quad (7)$$

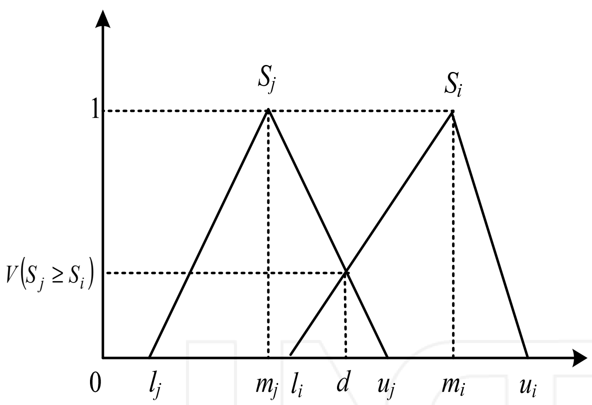


**Figure 3.** The intersection between $S_j$ and $S_i$.

Figure 3 represents $V(S_j \geq S_i)$, for the case $m_j < l_i < u_j < m_i$, where $d$ is the abscissa value of the highest intersection point between $S_i$ and $S_j$.

We need both the values $V(S_j \geq S_i)$ and $V(S_i \geq S_j)$ to compare $S_i$ and $S_j$.

The minimum degree of possibility $d(i)$ of $V(S_j \geq S_i)$ for *i,j=1,2,...,k* is calculated, thus:

$$\begin{aligned} &V(S \geq S_1, S_2, S_3, ..., S_k) \\ &= V[(S \geq S_1) and (S \geq S_2) and ... (S \geq S_k)] \\ &= \min V(S \geq S_i) \end{aligned} \quad (8)$$

for *i=1,2,...,k*. Assume that:

$$d'(A_i) = \min V(S \geq S_i), \text{ for } i=1,2,...,k$$

Then the weight vector is defined as:

$$W' = (d'(A_1), d'(A_2), ..., d'(A_n))^T \quad (9)$$

where $A_i$ $(i = 1,2,3,...,n)$ comprises the $n$ elements. Finally, the weight vectors are normalized as follows:

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

where W is a non-fuzzy number.

## 4. The proposed framework to determine the relative factor weights

This study uses FAHP to determine the factor weights affecting tourism performance. The steps of the fuzzy AHP utilization in group multiple criteria decision-making are as follows:

*Step 1: Selecting decision-makers for assessment*

A committee of decision-makers was formed. In order to obtain an objective decision, the backgrounds of the decision-makers should be considered. Each member in the committee was required to provide judgments on the basis of personal knowledge and expertise. In our research, 207 experts were invited to evaluate the factors and sub-factors; 125 of these experts sent back their completed questionnaires. They included lecturers at the Tourism University, employees at the Vietnam National Administration of Tourism, and managers of various tourism organizations. These experts have all experience in our research topic. The research period ran from June 2012 to December 2012.

*Step 2: Making pairwise comparisons and obtaining the individual judgment matrices*

The decision-makers make pairwise comparisons of the importance of (or their preference for) each pair of factors. The comparison of one factor over another is in the form of linguistic variables and can be done with the help of questionnaires. A linguistic variable is a variable whose values are words or sentences in a natural or artificial language [23]. In this paper, TFNs are used to represent subjective pairwise comparisons of decision-makers, namely “Equally important”, “Moderately more important”, “Strongly more important”, “Very strongly more important”, and “Absolutely more important”. The linguistic variables and fuzzy scales for importance, which are proposed by [24], are used to convert such linguistic variables into TFNs. They are shown in Figure 4 and Table 2.

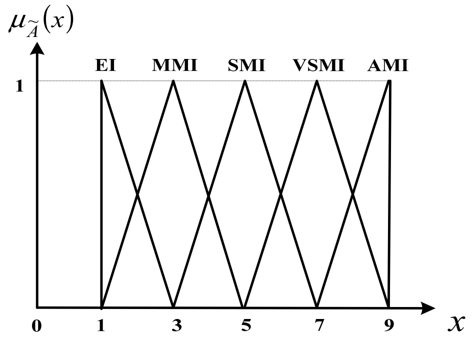


**Figure 4.** Fuzzy membership functions for linguistic variables.

| Linguistic variable for importance | Triangular fuzzy number |
|---|---|
| Equally important (EI) | (1,1,3) |
| Moderately more important (MMI) | (1,3,5) |
| Strongly more important (SMI) | (3,5,7) |
| Very strongly more important (VSMI) | (5,7,9) |
| Absolutely more important (AMI) | (7,9,9) |

**Table 2.** Linguistic variables and fuzzy scales for importance.

Through the use of questionnaires and the fuzzy comparison scale, a fuzzy reciprocal comparison matrix can be constructed from the results of pairwise comparisons.

Let us consider a problem at one level with $n$ factors, where the relative importance of factors $i$ to $j$ is represented by TFNs $\widetilde{a}_{ij}=(l_{ij},m_{ij},u_{ij})$. For example, one decision-maker considers that factor $i$ is strongly more important than factor $j$; he/she may set $\widetilde{a}_{ij}=(3,5,7)$. If factor $j$ is thought to be strongly more important than factor $i$, the pairwise comparison between $i$ and $j$ could be presented by $\widetilde{a}_{ij}=(1/7,1/5,1/3)$. The decision-maker must provide $n(n-1)/2$ comparison judgments.

As in the traditional AHP, the comparison matrix $\widetilde{A}=\{\widetilde{a}_{ij}\}$ can be constructed, such that:

$$\widetilde{A}=\begin{bmatrix} 1 & \widetilde{a}_{12} & \cdots & \widetilde{a}_{1n} \\ \widetilde{a}_{21} & 1 & \cdots & \widetilde{a}_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ \widetilde{a}_{n1} & \widetilde{a}_{n2} & \cdots & 1 \end{bmatrix} = \begin{bmatrix} 1 & \widetilde{a}_{12} & \cdots & \widetilde{a}_{1n} \\ 1/\widetilde{a}_{12} & 1 & \cdots & \widetilde{a}_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ 1/\widetilde{a}_{1n} & 1/\widetilde{a}_{2n} & \cdots & 1 \end{bmatrix} \quad (11)$$

*Step 3: Checking the consistency of individual comparison matrices*

To ensure a decision's quality, the consistency of the evaluation has to be analysed. Saaty [4] has proposed a consistency index that measures the consistency of comparison matrices. This index can be used to indicate the consistency of the pairwise comparison matrices (that are larger than 2x2). To investigate the consistency, the fuzzy comparison matrices need to be converted into crisp matrices. When a crisp matrix is consistent, this means that the fuzzy matrix is also consistent. The operation of converting a fuzzy number into a crisp number is called 'defuzzification'. There are various defuzzification methods reported in the literature. Some significant works include the weighted distance method of Saneifard [25], the simple centroid method of Chang and Wang [26] to get the best non-fuzzy performance value (BNP), the converting of fuzzy data into crisp scores (CFCS) method by Opricovic and Tzeng [27], the fuzzy mathematical programming method introduced by Mikhailov [28], and the lambda-max method proposed by Csutora and Buckley [29]. In this paper, we select the method proposed by Chang, Wu and Lin [30] to defuzzify the fuzzy numbers. This method can clearly express fuzzy perception. Owing to the exhibited preferences $(\alpha)$ and risk tolerances $(\lambda)$ of the decision-makers, they could understand the uncertainties that they face under different circumstances. A TFN denoted as $\widetilde{a}_{ij}=(l_{ij},m_{ij},u_{ij})$ can be defuzzified to a crisp number as follows:

$$a_{ij}=\left\lfloor \lambda . l_{ij}^{\alpha}+(1-\lambda)u_{ij}^{\alpha}\right\rfloor, 0\le\lambda\le1, 0\le\alpha\le1 \quad (12)$$

where $l_{ij}^{\alpha}=(m_{ij}-l_{ij}).\alpha+l_{ij}$ denotes the left-end value of $\alpha$-cut for $a_{ij}$, and $u_{ij}^{\alpha}=u_{ij}-(u_{ij}-m_{ij}).\alpha$ denotes the right-end value of $\alpha$-cut for $a_{ij}$. Noticeably, $\alpha$ can be considered as a stable or fluctuating condition and is any number from 0 to 1. The decision-making environment stabilizes when $\alpha$ increases. The degree of uncertainty is the highest when $\alpha$=0. Additionally, $\lambda$ can be considered as the degree of a decision-maker's optimism, and its range is between 0 and 1. When $\lambda$ is 0, the decision-maker is highly optimistic. Conversely, when $\lambda$ is 1, the decision-maker is pessimistic. In our study, $\alpha$=0.5 is used to denote that environmental uncertainty is steady, while $\lambda$=0.5 expresses that the attitude is fair.

After all the elements in the comparison matrix have been converted from TFNs to crisp numbers, the comparison matrix can be expressed as follows:

$$A=\begin{bmatrix} 1 & a_{12} & \dots & a_{1n} \\ a_{21} & 1 & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & 1 \end{bmatrix} \quad (13)$$

The consistency index, CI, for a comparison matrix, can be computed with the use of the following equation:

$$CI = \frac{\lambda_{max} - n}{n-1} \quad (14)$$

where $\lambda_{max}$ is the largest eigenvalue of the comparison matrix and $n$ is the dimension of the matrix.

The consistency ratio [4] is defined as a ratio between the consistency of a given evaluation matrix and the consistency of a random matrix:

$$CR = \frac{CI}{RI(n)} \quad (15)$$

where $RI(n)$ is a random index (RI) [31] that depends on $n$, as shown in Table 3.

| *N* | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|
| *RI(n)* | 0.58 | 0.9 | 1.12 | 1.24 | 1.32 | 1.41 | 1.45 |

**Table 3.** A random index of random matrices.

If the consistency ratio (CR) of a comparison matrix is equal to or less than 0.1, it may be acceptable. When the CR is unacceptable, the decision-maker is encouraged to repeat the pairwise comparisons.

In this step, the MATLAB package is employed to calculate the eigenvalues of all comparison matrices.

*Step 4: Constructing the group judgment matrices*

Since each individual judgment matrix represents the opinion of one decision-maker, aggregation is necessary to achieve a group consensus of decision-makers. In the conventional AHP, there are two basic approaches for aggregating the individual preferences into a group preference, namely, the aggregation of individual judgments (AIJ) and the aggregation of individual priorities (AIP) [32]. The concepts and ideas employed in the conventional AHP can also be utilized in the FAHP. In this research, the AIJ approach is used. In the AIJ approach, the group judgment matrix is obtained from the individual judgment matrices. This means that the group judgment matrix is considered as the judgment matrix of a 'new individual' and the priorities of this individual are derived as a group solution. Here, the geometric mean method is used to establish the representative comparison fuzzy matrix for a group decision. We consider a group of $K$ decision-makers involved in the research. They make pairwise comparisons of $n$ factors. As a result of the pairwise comparison, we get a set of $K$ matrices $\tilde{A}_k = \{\tilde{a}_{ijk}\}$, where $\tilde{a}_{ijk}=(l_{ijk},m_{ijk},u_{ijk})$ represents the relative importance of factors $i$ to $j$, as assessed by the expert $k$. The TFNs in the matrix can be obtained by using the following equation [8], [33]:

$$l_{ij} = \min_{k=1,2,..K}(l_{ijk})$$

$$m_{ij} = \sqrt[K]{\prod_{k=1}^{K} m_{ijk}}$$

$$u_{ij} = \max_{k=1,2,..K}(u_{ijk}) \quad (16)$$

When making comparisons of all the elements with respect to the upper level, the comparison matrices of decision-makers at the level were derived. Next, the *CR* values for all the matrices were determined by employing (13)-(15). From the consistency test results of the comparison matrices from each decision-maker, it was found that they were all less than 10%. Therefore, the consistency in each matrix was acceptable. The group judgment matrices were then obtained by employing (16). The results are shown in Tables 4-7.

| | $A_1$ | $A_2$ | $A_3$ |
|---|---|---|---|
| $A_1$ | (1,1,1) | (1,3.383,7) | (1,2.449,7) |
| $A_2$ | (0.143,0.296,1) | (1,1,1) | (0.333,1,1) |
| $A_3$ | (0.143,0.408,1) | (1,1,3) | (1,1,1) |

**Table 4.** The group judgment matrix of the factors with respect to the objective.

| | $A_{11}$ | $A_{12}$ | $A_{13}$ |
|---|---|---|---|
| $A_{11}$ | (1,1,1) | (1,4.296,9) | (1,4.296,9) |
| $A_{12}$ | (0.111,0.233,1) | (1,1,1) | (1,1,3) |
| $A_{13}$ | (0.111,0.233,1) | (0.333,1,1) | (1,1,1) |

**Table 5.** The group judgment matrix of the sub-factors with respect to 'promotional activities'.

| | $A_{21}$ | $A_{22}$ | $A_{23}$ | $A_{24}$ |
|---|---|---|---|---|
| $A_{21}$ | (1,1,1) | (0.2,0.559,3) | (0.143,0.2,0.333) | (1,3,5) |
| $A_{22}$ | (0.333,1.789,5) | (1,1,1) | (0.143,0.262,1) | (1,3.932,7) |
| $A_{23}$ | (3,5,7) | (1,3.815,7) | (1,1,1) | (3,5.858,9) |
| $A_{24}$ | (0.2,0.333,1) | (0.143,0.254,1) | (0.111,0.171,0.333) | (1,1,1) |

**Table 6.** The group judgment matrix of the sub-factors with respect to 'destination attributes'.

| | $A_{31}$ | $A_{32}$ | $A_{33}$ |
|---|---|---|---|
| $A_{31}$ | (1,1,1) | (0.143,0.287,1) | (1,1.908,5) |
| $A_{32}$ | (1,3.486,7) | (1,1,1) | (1,4.708,7) |
| $A_{33}$ | (0.2,0.524,1) | (0.143,0.212,1) | (1,1,1) |

**Table 7.** The group judgment matrix of the sub-factors with respect to 'destination image'.

*Step 5: Calculating the weights*

When the group decision matrices are obtained, Chang's extent analysis method is employed to calculate the weights of the factors and sub-factors. For identifying the computation stages clearly, we take the calculation of local weights from Table 4 as an example. Using (3) through to (6), we were able to determine the values of the fuzzy synthetic extent with respect to the three factors:

$$S_{A1} = (3,6.832,15) \otimes \left( \frac{1}{23}, \frac{1}{11.536}, \frac{1}{6.619} \right) = (0.13,0.592,2.266)$$

$$S_{A2} = (1.476,2.296,3) \otimes \left( \frac{1}{23}, \frac{1}{11.536}, \frac{1}{6.619} \right) = (0.064,0.199.0.453)$$

$$S_{A3} = (2.143,2.408,5) \otimes \left( \frac{1}{23}, \frac{1}{11.536}, \frac{1}{6.619} \right) = (0.093,0.209,0.755)$$

These values were compared by using (7). Table 8 shows the value of $V(S_{Ai} \geq S_{Aj})$.

The priority weights were then calculated:

$$d'(A_1)=min(1,1,1)=1$$
$$d'(A_2)=min(0.8987,1,1)=0.451$$
$$d'(A_3)=min(0.6855,0.8045,1,1)=0.620$$

Then the weight vector is as follows:

$$W'=(1,0.451,0.62)^T$$

| $V(S_{A1} \geq S_{Aj})$ | Value | $V(S_{A2} \geq S_{Aj})$ | Value | $V(S_{A3} \geq S_{Aj})$ | Value |
|---|---|---|---|---|---|
| $V(S_{A1} \geq S_{A2})$ | 1 | $V(S_{A2} \geq S_{A1})$ | 0.451 | $V(S_{A3} \geq S_{A1})$ | 0.620 |
| $V(S_{A1} \geq S_{A3})$ | 1 | $V(S_{A2} \geq S_{A3})$ | 0.974 | $V(S_{A3} \geq S_{A2})$ | 1 |

**Table 8.** Values of $V(S_{Ai} \geq S_{Aj})$

After the normalization of these values, the relative weights of the three factors were obtained. They are as follows:

$$W=(0.483,0.218,0.299)^T$$

The local weights from Tables 5-7 were calculated in a similar way. The calculated weights are given in Table 9. The global weight of each sub-factor is calculated by multiplying its local weight with its corresponding weight along the hierarchy. These global weights represent the rating of the sub-factors.

The weights and rankings of factors and sub-factors provide the answer for the research problem. The results of the opinions from decision-makers show that the promotional activities are the most important factors, with a weight of 0.483. Destination image ranked second at 0.299, while destination attributes ranked third, with a weight of 0.218. According to the viewpoints of the experts, promotional activities are most important factor, as it is the first step to attracting tourists. The destination image is placed second. This seems reasonable because the visitors only know the destination after they have been provided with information through promotional activities. Regarding the sub-factors, it was interesting to find that the price (perceived value) was not the most important factor. It was indicated that the most important sub-factors affecting tourism performance are tourism policy and tourist satisfaction. The findings of the study are also found to be consistent with the relationships derived from the literature and the current state of the Vietnamese tourism industry.

| Factor | Local weight | Sub-factor | Local weight | Global weight | Ranking |
|---|---|---|---|---|---|
| Promotional Activities ($A_1$) | 0.483 | Tourism Policy ($A_{11}$) | 0.512 | 0.247 | 1 |
| | | Promotion Budget ($A_{12}$) | 0.284 | 0.137 | 3 |
| | | Promotion Strategy ($A_{13}$) | 0.204 | 0.099 | 5 |
| Destination Attributes ($A_2$) | 0.218 | Natural Resource ($A_{21}$) | 0.234 | 0.051 | 9 |
| | | Cultural Resource ($A_{22}$) | 0.301 | 0.065 | 7 |
| | | Human Resource ($A_{23}$) | 0.410 | 0.089 | 6 |
| | | Tourism Facilities ($A_{24}$) | 0.056 | 0.012 | 10 |
| Destination Image ($A_3$) | 0.299 | Perceived Value ($A_{31}$) | 0.332 | 0.099 | 4 |
| | | Tourist Satisfaction ($A_{32}$) | 0.479 | 0.143 | 2 |
| | | Tourist Loyalty ($A_{33}$) | 0.189 | 0.056 | 8 |

**Table 9.** Local and global weights of the hierarchical structure.

## 5. Conclusions

Tourism is one of the fastest growing industries in the world. It is considered to be a means of improving national and regional economies, as it may attract investment, increase income and create new jobs. It is necessary to know to what extent the main factors influence tourism performance. In this paper, we proposed a framework for prioritizing the relative factor weights affecting tourism performance based on the FAHP method. In order to illustrate the proposed framework, a case application relating to the Vietnamese tourism context was also presented in this paper. The results show that the factors have different levels in influencing tourism performance efficiency, with promotional activities being more important than the others. Based on these results, the tourism managers and planners can decide to concentrate resources and effort on the factors that can most effectively improve tourism performance efficiency. The findings of this study also consolidated the theory of tourism planning in the context of Vietnam. This study may be used as a reference for the planning and development of tourism performance. We also hope that our proposed framework may be applied to deal with both group decisions and fuzziness in other multiple-criteria decision-making real-world problems. For further research, visitors' opinions will be taken into consideration so as to make the study more comprehensive. Regarding the deployment of the fuzzy AHP in the group decision-making process, both dispersion and homogeneity in individual judgments and their effect on group decisions could be taken into consideration, especially when only one or a few experts deliver extreme comparison results.

## 6. Acknowledgements

This study was supported by the National Science Council of Taiwan under Grant No. NSC 101-2221-E-035-034.

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