Research Article

Constructing a Travel Risks' Evaluation Model for Tour Freelancers Based on the ANP Approach

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This study constructs a new travel risks' evaluation model for freelancers to evaluate and select tour groups by considering the interdependencies of the evaluation criteria used. First of all, the proposed model adopts the Nominal Group Technique (NGT) to identify suitable evaluation criteria for evaluating travel risks. Six evaluation criteria and 18 subcriteria are obtained. The six evaluation criteria are financial risk, transportation risk, social risk, hygiene risk, sightseeing spot risk, and general risk for freelancer tour groups. Secondly, the model uses the analytic network process (ANP) to determine the relative weight of the criteria. Finally, examples of group package tours (GPTs) are used to demonstrate the travel risk evaluation process for this model. The results show that the Tokyo GPT is the best group tour. The proposed model helps freelancers to effectively evaluate travel risks and decision-making, making it highly applicable to academia and tour groups.

1. Introduction

Typically, travel agencies put together several services provided by several distinct travel-related industries to offer a favourable tour experience [1–3]. The group package tour (GPT), or the organized mass tour, is one of the major forms of outbound travel in many parts of Asia [1, 2, 4–7]. The most distinctive feature of the GPT is the presence of a tour leader, who provides various services to the tour participants [7]. These types of outbound travel provide tour participants with a convenient and fast excursion environment that also offers certain quality products and services, saving the tourist time and money.

Nowadays, competition among travel agencies is intense. In order to economise on personnel-related costs, many travel agencies employ experienced freelancers, who exclusively service tour groups in the peak season. Geva and Goldman [8] have indicated that one of the most important tasks for the tour leader is to solve problems and to escort tour participants so that the tour leader can maintain a tour's quality and keep them satisfied if something goes wrong or a travel risk

arises. Therefore, freelancers play an important role in GPTs. Freelancer GPT travel risk evaluation involves multicriteria decision-making (MCDM). MCDM is designed to employ a set of criteria for a decision problem [9–13]. Thus, this paper focuses on the evaluation of travel risk and how the selection of best GPTs meets the freelancer's needs. These needs are met by reducing travel risk gaps introduced by interdependence and feedback problems occurring among the different criteria and subcriteria, allowing a high evaluation level to be achieved and promoting freelancers' ability to provide tour participants with favourable tour experiences. It is essential for freelancers to know that the success of leading a group tour depends on effective management and the careful preparation of tasks beforehand.

There are other terms used to describe a tour leader which are tour manager, tour escort, tour conductor, tour director, and tour courier [14]. Tour leaders are both front-line service providers, whose presentation can make or break a tour, and administrators, who carry out various duties in the tour duration [7, 15]. The tour leaders can be divided into two types: employees and freelancers [16]. The employee tour leader

is a company's full-time employee. The freelancer is a self-employed person and is not committed to an employer long-term. Leading a group tour is a complex task, encompassing risks that can arise in restaurants, hotels, attractions, airlines, and motorcoaches or while shopping or being involved in amusement activities and optional tours, and so forth [6]. Nowadays, increasing number of travel risk issues leads to more consumer concerns. Some traditional experiences are unable to be met; thus, by travel risk evaluation for freelancers not only can they promote a better, more efficient evaluation of the decision-making process, but they also easily maintain the quality of a tour group while improving their earnings.

Previous travel risks studies have focused on the tourist's perspective [16–20], the tour leader's perspective [6, 21], the effects of religious affiliation [22], and the effects of diseases and viruses [23, 24]. Additional studies have addressed the pervasiveness of tourists' judgements of food-related risks [25]. In general, research has examined adventure tourism operators in relation to tourist accidents and injuries [26], tourists' voluntary risk-taking behaviours [27], or consumers' different cognition of perceived risk attributes [28]. In the literature, there are few MCDM theories aimed at evaluating the travel risk model. There exists, so far, no complete set of travel risk evaluation models of the tourism market for freelancer operations, even though the tourism industry has rapidly grown. This study attempts to use the analytic network process (ANP) approach to determine the relative weights of multiple evaluation criteria and then decide what the best alternatives of GPT are in terms of an overall evaluation criteria set. As a method, the ANP reconstructs a complex MCDM problem as a hierarchy [29]. Thus, this study provides an effective rationale model for a freelancer to evaluate the GPT travel risks.

2. Methodology

2.1. Nominal Group Technique (NGT). The importance of tour leader's views is now increasingly recognised, particularly as customers are more likely to use a service that meets their specific needs. Given the growing emphasis on addressing the rising rates of travel risks and customers complaints, tour managers are more likely to seek freelancers' opinions and priorities. However, opinion varies as to the best method(s) to elicit freelancer evaluations [30]. When collecting opinion for a needs' evaluation, prioritizing needs, or making recommendations for action based on needs evaluation findings, the nominal group technique can be a valuable tool for facilitating group decision-making.

NGT is a structured variation of a small-group discussion aimed at reaching consensus, where all ideas have equal importance. The indicators are decided not only according to the criteria adopted by modifying/deleting from relevant prior research but also according to criteria selected by a panel of tourism experts to determine the hierarchical criteria set. The process forces everyone to participate, and no dominant person is allowed to control the proceedings. Furthermore, NGT is more likely to reach a clear outcome, providing a sense of achievement for participants [31]. Importantly,

TABLE 1: Proposed criterion and their related subcriteria.

Criteria	Subcriteria
Financial risk (C_1)	Travel agency goes bankrupt (C_{11}), pocket-picker (C_{12})
Transportation risk (C_2)	Safety of transportation (C_{21}), safety of driving (C_{22}), convenient telecommunication facilities (C_{23}), public transit delayed or canceled (C_{24})
Social risk (C_3)	Political and economic instability (C_{31}), possibility of terrorist activities (C_{32}), assistance available of accident (C_{33})
Hygiene risk (C_4)	Hygiene of catering conditions (C_{41}), possibility of infectious diseases (C_{42})
Sightseeing spot risk (C_5)	Safety of recreational facilities (C_{51}), prearranged meeting point/time (C_{52})
General risk (C_6)	Check itinerary and flight status (C_{61}), ensure meeting point and times (C_{62}), customer complaints (C_{63}), image of the country/destination (C_{64}), hotel security system (C_{65})

NGT requires less time and resources than the Delphi technique [32]. We adopt NGT [32, 33] to determine the hierarchical criteria set and their interdependence properties to help a freelancer identify travel risks priority measure indicators of GPT.

Delbecq et al. [32] suggested five to eight individuals as an appropriate number of members in an NGT, and, thus, this study employed a decision-making group comprising seven experts. To simplify the process and avoid any misunderstanding, the interaction between any of these criteria is not considered in the first instance. Six evaluation criteria and 18 subcriteria are determined through the NGT process, as shown in Table 1. The criteria set may not include all of the decision factors in the GPT travel risk evaluation. However, they are the most meaningful measures in our case and have been stressed in numerous leading articles.

2.2. Analytic Network Process (ANP). ANP is a comprehensive decision-making technique that has the capability to include all the relevant criteria in arriving at a decision [34]. ANP is an extension of analytic hierarchy process (AHP) and allows for more complex interdependent relationships between elements [34]. AHP models assume that there are unidirectional relationships between elements of different decision levels along the hierarchy and uncorrelated elements within each cluster as well as between clusters. It is not appropriate for models that specify interdependent relationships in AHP. Therefore, this study includes this advantage using the ANP. The structural difference between a hierarchy and a network is depicted in Figure 1. ANP comprises four major steps [35, 36].

Step 1 (model construction and problem structuring). The problem should be stated clearly and transformed into a rational system like a network. The structure can be obtained via the opinion of decision-makers through brainstorming or

FIGURE 1: Structural difference between (a) a hierarchy and (b) a network, Chang et al. [29].

other appropriate methods. Figure 1(b) shows an example of the network format.

Step 2 (pairwise comparisons of matrices and priority vectors). The normal procedure for a pairwise comparison involves inviting experts to compare a series of pairwise comparisons in which two elements or two components at a time are compared in terms of their contribution to their particular upper level criterion [37]. The relative importance values are determined on a scale of 1 to 9, where 1 represents the equal importance of the two compared elements and 9 indicates the heightened importance of one element (row component in the matrix) versus the other one (column component in the matrix) [37]. A reciprocal value is assigned to the inverse comparison (i.e., $a_{ji} = 1/a_{ij}$, $i \neq j$; $a_{ij} = 1$, $i = j$, $i, j = 1, 2, \dots, n$), where a_{ij} denotes the importance of i_{th} element compared to j_{th} element. A pairwise comparison in ANP is made in the framework of a matrix, and a local priority vector can be obtained to estimate the relative importance of the elements being compared by applying the following equation:

$$A \cdot w = \lambda_{\max} \cdot w, \quad (1)$$

where A is the pairwise comparison matrices, w represents the eigenvector, and $\lambda_{\max}$ is the largest eigenvalue of A [38]. If A denotes a consistency matrix, then eigenvector X can be determined using

$$(A - \lambda_{\max} I) X = 0. \quad (2)$$

Saaty [38] proposed adopting the consistency index (CI) and consistency ratio (CR) to verify the consistency of the comparison matrix. The CI and RI are defined as follows:

$$\begin{aligned} CI &= \frac{(\lambda_{\max} - n)}{(n - 1)}, \\ CR &= \frac{CI}{RI}, \end{aligned} \quad (3)$$

where RI denotes the average consistency index for numerous random entries of the same order reciprocal matrices. If CR

≤ 0.1 , then the estimate is accepted; otherwise, a new comparison matrix is solicited until $CR \leq 0.1$.

Step 3 (supermatrix formation). The supermatrix concept resembles the Markov chain process [35]. To obtain global priorities in a system with interdependent influences, the local priority vectors are added to the appropriate columns of a matrix, known as a supermatrix. A supermatrix is actually a partitioned matrix, where each matrix segment represents a relationship between two nodes (components or clusters) in a system [37]. Let the components of a decision system be C_i , $i = 1, 2, \dots, n$, in which each component C_i has j elements, denoted as e_{ij} , $j = 1, 2, \dots, m$. The local priority vectors obtained in Step 2 are grouped and located in appropriate positions in a supermatrix based on the flow of influence from one component to another or from a component to itself, as in the loop. Equation (4) presents a standard form of a supermatrix [35]. Consider

$$W = \begin{matrix} & \begin{matrix} C_1 & C_2 & \cdots & C_i \end{matrix} \\ \begin{matrix} C_1 \\ \vdots \\ e_{1j} \\ e_{21} \\ C_2 \\ e_{22} \\ \vdots \\ e_{2j} \\ \vdots \\ C_i \\ e_{i1} \\ e_{i2} \\ \vdots \\ e_{ij} \end{matrix} & \begin{bmatrix} e_{11}e_{12} \cdots e_{1j} & e_{21}e_{22} \cdots e_{2j} & \cdots & e_{i1}e_{i2} \cdots e_{ij} \\ w_{11} & w_{12} & \cdots & w_{1j} \\ w_{21} & w_{22} & \cdots & w_{2j} \\ \vdots & \vdots & \ddots & \vdots \\ w_{i1} & w_{i2} & \cdots & w_{ij} \end{bmatrix} \end{matrix} \quad (4)$$

As an example, the supermatrix representation in a hierarchy with three levels is shown as

$$W_h = \begin{bmatrix} 0 & 0 & 0 \\ w_{21} & 0 & 0 \\ 0 & w_{32} & I \end{bmatrix}, \quad (5)$$

where w_{21} is a vector that represents the effect of the goal on the criteria, w_{32} is a matrix denoting the effect of criteria on each of the alternatives, I is the identity matrix, and entries of zeros indicate elements that have no influence. For the above example, if the criteria are interrelated, the (2, 2) entry of W_n given by w_{22} would indicate the interdependency, and the supermatrix would be [35]

$$W_n = \begin{bmatrix} 0 & 0 & 0 \\ w_{21} & w_{22} & 0 \\ 0 & w_{32} & I \end{bmatrix}. \quad (6)$$

Note that any zero in the supermatrix can be replaced by a matrix if there is an interrelationship of the elements in a component or between two components. Since interdependence generally exists among clusters in a network, a supermatrix usually has multiple columns. The supermatrix must be transformed first to make it stochastic; after being restated, each column of the matrix adds up to unity. This study used the ANP to weigh the criteria and subcriteria, and thus the equation supermatrix W_n must be modified slightly to W'_n :

$$W'_n = \begin{bmatrix} 0 & 0 & 0 \\ w_{21} & w_{22} & 0 \\ 0 & w_{32} & w_{33} \end{bmatrix}, \quad (7)$$

where the criteria and subcriteria are interrelated, w_{22} and w_{33} indicate the interdependency, and a network replaces the hierarchy.

A recommended approach by Saaty [35] is to determine the relative importance of the clusters in the supermatrix, with the column cluster (block) as the controlling component [37]. That is, the row components with nonzero entries for their blocks in that column block are compared according to their impact on the component of that column block [35]. An eigenvector can be obtained from the pairwise comparison matrices of the row components with respect to the column component. This process produces an eigenvector for each column block. For each column block, the first entry of the respective eigenvector is multiplied by all the elements in the first block of that column and the second is multiplied by all the elements in the second block of that column, and so on. In this way, the block in each column of the supermatrix is weighted, and the result is known as the weighted supermatrix, which is stochastic. Increasing a matrix to powers gives the long-term relative influence of the elements on one another. To achieve convergence of the importance weights, the weighted supermatrix is increased to the power of $2k + 1$, where k is an arbitrarily large number, and this new matrix is termed the limit supermatrix [35]. The limit supermatrix possesses the same form as the weighted

FIGURE 2: Network form for this paper.

supermatrix, but all the columns of the limit supermatrix are the same. Normalising each block of the supermatrix results in the final priorities of all the elements being obtained.

Step 4 (selection of the best alternatives). If the supermatrix formed in Step 3 covers the whole network, the priority weights of alternatives can be found in the column of alternatives in the normalised supermatrix. On the other hand, if a supermatrix only comprises interrelated components, additional calculations must be performed to obtain the overall priorities of the alternatives. The alternative with the largest overall priority should be the one selected. This study applies the first method, and a supermatrix that covers the whole network, as shown by the bracket in Figure 2, is then formed.

3. Constructing the Travel Risks Evaluation Model

The research problems were determined by a literature review. In order to acquire more comprehensive assessments, we established an expert group to assign the evaluation criteria and subcriteria.

3.1. Designation of the Group of Experts. Experts were invited to assess the content and relevance among the criteria and subcriteria. To avoid biases occurring, an expert group comprising seven professional experts from tourism-related industries was formed. We spent two more months between August and October 2015 gathering sufficient information. All of the experts were involved in the GPT travel risk evaluation model of the criteria selecting process. The tourism experts selected in this study comprised one doctorate holder who used an employed tour leader in a travel agency for ten years, one route control (RC) department manager from a wholesale travel agency, two scholars working in a tourism management department, and three senior freelancers who had been working for a travel agency for 22, 16, and 14 years, respectively. Therefore, the experts were able to consider various issues and then evaluate which one was the best based on their practical experience.

FIGURE 3: Hierarchical structure of travel risk evaluation model for freelancers.

FIGURE 4: Interdependence criteria of research model.

3.2. Determining the Evaluation Criteria Set and Travel Risk Model. This study seeks to assess GPT travel risk, which usually consists of multiple dimensions and criteria, and to determine the influential weights of those criteria. Based on the experts' opinions, we constructed a GPT travel risks' evaluation model for freelancers in this study. Figure 3 illustrates the hierarchical model of the GPT travel risk evaluation criteria (i.e., six criteria and 18 subcriteria).

According to the experts' suggestions, Figures 4 and 5 show the interdependence among the criteria set based on the hierarchical structure. The slender arrows imply a one- or two-way relationship. For example, the arrow that goes from financial risk and feeds into transportation risk infers that the criterion "financial risk" influences the criterion "transportation risk." Figure 4 shows that all of the criteria have an inner dependence relationship, except for hygiene risk and sightseeing spot risk. Similarly, Figure 5 shows the inner dependence between the subcriteria. For example,

criteria C_{11} and C_{12} , C_{12} and C_{21} , ..., and C_{62} and C_{63} are independent.

4. Empirical Study and Discussion

Due to the interdependence existing among the criteria set, the ANP approach was adapted to compute the relative weights of the criteria. Super Decision software is used to rank the alternatives and select the best travel risks. After entering the normalised values into the supermatrix and completing the stochastic column, the power of the supermatrix is raised until convergence occurs [35, 36].

4.1. Demonstrating the Empirical Study. In this study, we assumed that the group size, tour duration, and earnings were the same among the various GPTs. The criteria were set for freelancers deciding on the best group tour itinerary.

TABLE 2: Pairwise comparison matrices for criteria of level 2.

Criteria	Financial (C_1)	Transportation (C_2)	Social (C_3)	Hygiene (C_4)	Scenic Spot (C_5)	General (C_6)	Weights
Financial (C_1)	1	0.796	1.171	1.186	1.472	3.630	0.203
Transportation (C_2)	1.256	1	1.483	1.515	1.863	4.601	0.257
Social (C_3)	0.854	0.674	1	1.012	1.276	3.104	0.174
Hygiene (C_4)	0.843	0.660	0.988	1	1.252	3.077	0.172
Scenic spot (C_5)	0.679	0.537	0.784	0.799	1	2.469	0.138
General (C_6)	0.275	0.217	0.322	0.325	0.405	1	0.056

$\lambda_{\max} = 6.000$; CI = 0; and CR = $0.000 \leq 0.1$ consistency.

FIGURE 5: Interdependence subcriteria of research model.

Consequently, the empirical study represents three famous GPTs as alternative cases which is dependent on the experts' suggestions, comprising A_1 : a five-day itinerary of Tokyo (TYO), Japan, A_2 : a five-day itinerary of Hong Kong and Macau (HKG), Hong Kong, and A_3 : a five-day itinerary of Guangxi Guilin (KWL), China. The researchers gathered data from October to December 2015. In total, research on 35 freelancer tour leaders was conducted. The results present the overall scores and the order of alternatives. The ranking was obtained and validated through the above-described analytical process, which considers that freelancers evaluate GPT travel risks in travel agencies according to the method and summarised the computational procedure with the following steps.

Step 1 (establish the pairwise comparison matrices and determine weights). This study uses six evaluation criteria and 18 subcriteria as the model for establishing a travel risks' evaluation criteria set. Firstly, the importance of the weights of the criteria and subcriteria had to be obtained. For this reason, the experts were asked to assess all proposed criteria and subcriteria in a pairwise fashion while assuming that no interdependence existed. The normalised weights were calculated as a unique solution as represented by w_{21} , which shows the related local priority of the criteria. w_{32} represents

TABLE 3: Pairwise comparison matrices for criteria of level 3.

Subcriteria	Travel agency goes bankrupt (C_{11})	Pocket-picker (C_{12})	Weights
Travel agency goes bankrupt (C_{11})	1	0.690	0.408
Pocket-picker (C_{12})	1.449	1	0.592

$\lambda_{\max} = 2.000$; CI = 0; and CR = $0.000 \leq 0.1$ consistency.

the related importance of the subcriteria in terms of their upper level criteria. The pairwise comparison matrices for the criteria and subcriteria are shown in Tables 2 and 3.

The weights for level 2 to level 3 lists in Table 4 include the respective weights of the six evaluative criteria (w_{21}) and the respective weights of the 18 evaluative subcriteria (w_{32}). Assuming that there is no interdependence among the criteria and subcriteria, which criteria and subcriteria should be emphasised more in determining their respective upper level criterion? As indicated in Table 4, the critical order of the six evaluation criteria for the travel risk evaluation model is financial risk (0.203), transportation risk (0.257), social risk

TABLE 4: Weights for level 2 and level 3.

Criteria	Weights of criteria (w_{21})	Subcriteria	Weights of subcriteria (w_{32})
C_1	0.203	C_{11}	0.408
		C_{12}	0.592
C_2	0.257	C_{21}	0.264
		C_{22}	0.288
		C_{23}	0.176
		C_{24}	0.272
C_3	0.174	C_{31}	0.340
		C_{32}	0.282
		C_{33}	0.378
C_4	0.172	C_{41}	0.534
		C_{42}	0.466
C_5	0.138	C_{51}	0.510
		C_{52}	0.490
		C_{61}	0.240
		C_{62}	0.234
C_6	0.056	C_{63}	0.220
		C_{64}	0.088
		C_{65}	0.218

$$w_{22} = \begin{matrix} & C_1 & C_2 & C_3 & C_4 & C_5 & C_6 \\ \begin{matrix} C_1 \\ C_2 \\ C_3 \\ C_4 \\ C_5 \\ C_6 \end{matrix} & \begin{bmatrix} 0 & 0 & 0.260 & 0 & 0 & 0.294 \\ 0.420 & 0 & 0.300 & 0 & 0 & 0.376 \\ 0 & 0.460 & 0 & 0.463 & 0.446 & 0.331 \\ 0.257 & 0 & 0.207 & 0 & 0 & 0 \\ 0.322 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.540 & 0.233 & 0.537 & 0.554 & 0 \end{bmatrix} \end{matrix},$$

$$w_{33} = \begin{matrix} & C_{11} & C_{12} & C_{21} & C_{22} & C_{23} & C_{24} & C_{31} & C_{32} & C_{33} & C_{41} & C_{42} & C_{51} & C_{52} & C_{61} & C_{62} & C_{63} & C_{64} & C_{65} \\ \begin{matrix} C_{11} \\ C_{12} \\ C_{21} \\ C_{22} \\ C_{23} \\ C_{24} \\ C_{31} \\ C_{32} \\ C_{33} \\ C_{41} \\ C_{42} \\ C_{51} \\ C_{52} \\ C_{61} \\ C_{62} \\ C_{63} \\ C_{64} \\ C_{65} \end{matrix} & \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.141 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.117 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.122 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.104 & 0.211 \\ 0.122 & 0 & 0 & 0.373 & 0 & 0.415 & 0 & 0 & 0.151 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.079 & 0 \\ 0.141 & 0 & 1 & 0 & 0 & 0.369 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.082 & 0.088 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.075 & 0 & 0.082 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.160 & 0 & 0 & 0 & 0 & 0.416 & 0.294 & 0.121 & 0 & 0 & 0 \\ 0.297 & 0.484 & 0 & 0 & 0 & 0 & 0 & 0 & 0.469 & 0.127 & 0 & 0 & 0 & 0 & 0.289 & 0 & 0 & 0.097 & 0.135 \\ 0 & 0 & 0 & 0.292 & 0 & 0.217 & 0.504 & 0 & 0.153 & 0 & 0 & 1 & 0.430 & 0.294 & 0.193 & 0 & 0.093 & 0.161 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.121 & 0.108 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.613 & 0 & 0 & 0 & 0 & 0 & 0.139 & 0.139 & 0.103 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.496 & 0 & 0 & 0.654 & 0 & 0 & 0 & 0 & 0 & 0 & 0.101 & 0.103 \\ 0.235 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.361 & 0 & 0 & 0 & 0.094 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.243 & 0.072 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.270 & 0.066 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.335 & 1 & 0 & 0 & 0 & 0 & 0.346 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.088 & 0.129 \\ 0.205 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.269 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.049 & 0 & 0.078 \\ 0 & 0.516 & 0 & 0 & 0 & 0 & 0 & 0 & 0.263 & 0.146 & 0 & 0.387 & 0 & 0.209 & 0 & 0 & 0.063 & 0.103 & 0 \end{bmatrix} \end{matrix}. \quad (8)$$

If we introduced a supermatrix for the criteria by simply connecting each criterion to itself, our entries would normally be equal to one. However, our supermatrix needed to be stochastic to ensure convergence. To do that in this case, we had to assign equal weights to the two

(0.174), hygiene risk (0.172), sightseeing spot risk (0.138), and general risk (0.056).

Step 2 (establish the supermatrix and the limit matrix, which are listed as columns in Tables 5–7). The supermatrix considering interdependence can then be obtained by combining the results obtained by w_{21} , w_{22} , w_{32} , and w_{33} , as shown in Table 5. Table 5 presents the supermatrix, in addition to the respective vectors and matrices previously obtained. Since the supermatrix includes interactions between clusters, for example, inner dependence exists between criteria, not all of the columns add up to one. Additionally, the dependence between the selection criteria and subcriteria was considered and analysed, while ANP is introduced within this framework to obtain the weights of the criteria. The experts separately examined the impact of all the criteria using a pairwise comparison. The normalised weights for these matrices are calculated and presented as w_{22} and w_{33} , where zeros are assigned to the weights of the criteria and subcriteria on which a given criterion is based:

components, and, hence, our entries became 0.5 for the elements in the supermatrix [39]. A weighted supermatrix is transformed first into a stochastic value, as presented in Table 6. The current supermatrix reached convergence and obtained unique weights. Table 7 shows the final limit matrix,

TABLE 5: The unweighted supermatrix.

Level		II criteria										III subcriteria															
Level	Item	Goal	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₁₁	C ₁₂	C ₂₁	C ₂₂	C ₂₃	C ₂₄	C ₃₁	C ₃₂	C ₃₃	C ₄₁	C ₄₂	C ₅₁	C ₅₂	C ₆₁	C ₆₂	C ₆₃	C ₆₄	C ₆₅	
I	Goal	0	0	0	0.260	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
II	C ₁	0.203	0	0	0.260	0	0	0.294	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C ₂	0.257	0.420	0	0.300	0	0	0.376	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C ₃	0.174	0	0.460	0	0.463	0.446	0.331	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C ₄	0.172	0.257	0	0.207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C ₅	0.138	0.322	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C ₆	0.056	0	0.540	0.233	0.537	0.554	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
III	C ₁₁	0	0.398	0	0	0	0	0	0	0	0	0	0	0	0	0	0.141	0	0	0	0	0	0	0.117	0	0	
	C ₁₂	0	0.602	0	0	0	0	0	0	0	0	0	0	0	0	0	0.122	0	0	0	0	0	0	0	0.104	0.211	
	C ₂₁	0	0	0.214	0	0	0	0	0.122	0	0	0.373	0	0.415	0	0	0.151	0	0	0	0	0	0	0	0.079	0	
	C ₂₂	0	0	0.267	0	0	0	0	0.141	0	1	0	0	0.369	0	0	0	0	0	0	0	0	0	0.082	0.088	0	
	C ₂₃	0	0	0.245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.075	0	0.082	
	C ₂₄	0	0	0.273	0	0	0	0	0	0	0	0	0	0	0	0	0.160	0	0	0	0	0.416	0.294	0.121	0	0	
	C ₃₁	0	0	0	0.380	0	0	0	0.297	0.484	0	0	0	0	0	0.469	0.127	0	0	0	0	0.289	0	0	0.097	0.135	
	C ₃₂	0	0	0	0.247	0	0	0	0	0	0	0.292	0	0.217	0.504	0	0.153	0	0	0	1	0.430	0.294	0.193	0	0.093	0.161
	C ₃₃	0	0	0	0.373	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.121	0.108	0	
	C ₄₁	0	0	0	0	0.533	0	0	0	0	0	0	0	0	0	0	0	0	0.613	0	0	0	0	0.139	0.139	0.103	
	C ₄₂	0	0	0	0	0.467	0	0	0	0	0	0	0	0	0.496	0	0	0.654	0	0	0	0	0	0	0.101	0.103	
	C ₅₁	0	0	0	0	0	0	0.497	0.235	0	0	0	0	0	0	0	0	0	0	0	0.361	0	0	0.094	0	0	
	C ₅₂	0	0	0	0	0	0.503	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.243	0.072	0	0	
	C ₆₁	0	0	0	0	0	0	0	0.204	0	0	0	0	0	0	0	0	0	0	0	0	0	0.270	0.066	0	0	
	C ₆₂	0	0	0	0	0	0	0	0.230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C ₆₃	0	0	0	0	0	0	0	0.256	0	0	0.335	1	0	0	0	0	0	0.346	0	0	0	0	0	0.088	0.129	
	C ₆₄	0	0	0	0	0	0	0	0.110	0.205	0	0	0	0	0	0	0.269	0	0	0	0	0	0	0.049	0	0.078	
	C ₆₅	0	0	0	0	0	0	0	0.200	0	0.516	0	0	0	0	0	0.263	0.146	0	0.387	0	0.209	0	0.063	0.103	0	

TABLE 6: The weighted supermatrix.

Level		II criteria										III subcriteria															
Level	Item	Goal	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₁₁	C ₁₂	C ₂₁	C ₂₂	C ₂₃	C ₂₄	C ₃₁	C ₃₂	C ₃₃	C ₄₁	C ₄₂	C ₅₁	C ₅₂	C ₆₁	C ₆₂	C ₆₃	C ₆₄	C ₆₅	
I	Goal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
II	C ₁	0.203	0	0	0.130	0	0	0.147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C ₂	0.257	0.210	0	0.150	0	0	0.188	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C ₃	0.174	0	0.230	0	0.232	0.223	0.165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C ₄	0.172	0.129	0	0.104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C ₅	0.138	0.161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C ₆	0.056	0	0.270	0.117	0.268	0.277	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
III	C ₁₁	0	0.199	0	0	0	0	0	0	0	0	0	0	0	0	0	0.070	0	0	0	0	0	0	0	0.059	0	0
	C ₁₂	0	0.301	0	0	0	0	0	0	0	0	0	0	0	0	0	0.061	0	0	0	0	0	0	0	0	0.052	0.105
	C ₂₁	0	0	0.107	0	0	0	0	0.061	0	0	0.186	0	0.207	0	0	0.076	0	0	0	0	0	0	0	0	0.040	0
	C ₂₂	0	0	0.134	0	0	0	0	0.070	0	0.5	0	0	0.184	0	0	0	0	0	0	0	0	0	0	0.041	0.044	0
	C ₂₃	0	0	0.123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.038	0	0.041
	C ₂₄	0	0	0.137	0	0	0	0	0	0	0	0	0	0	0	0	0.080	0	0	0	0	0	0.208	0.147	0	0	0
	C ₃₁	0	0	0	0.190	0	0	0	0.149	0.242	0	0	0	0	0	0	0.234	0.064	0	0	0	0	0.145	0	0	0.048	0.067
	C ₃₂	0	0	0	0.124	0	0	0	0	0	0	0.146	0	0.108	0.252	0	0.076	0	0	0.500	0.215	0.147	0.097	0	0.046	0.080	
	C ₃₃	0	0	0	0.187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0605	0.054	0
	C ₄₁	0	0	0	0	0.266	0	0	0	0	0	0	0	0	0	0	0	0	0.306	0	0	0	0	0	0.069	0.070	0.051
	C ₄₂	0	0	0	0	0.234	0	0	0	0	0	0	0	0	0.248	0	0	0.327	0	0	0	0	0	0	0	0.051	0.051
	C ₅₁	0	0	0	0	0	0.249	0	0.117	0	0	0	0	0	0	0	0	0	0	0	0	0.181	0	0	0.047	0	0
	C ₅₂	0	0	0	0	0	0.251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.121	0.036	0	0
	C ₆₁	0	0	0	0	0	0	0	0.102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.135	0.033	0	0
	C ₆₂	0	0	0	0	0	0	0.115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C ₆₃	0	0	0	0	0	0	0.128	0	0	0	0.168	0.5	0	0	0	0	0.173	0	0	0	0	0	0	0	0.044	0.064
	C ₆₄	0	0	0	0	0	0	0.055	0.103	0	0	0	0	0	0	0	0.134	0	0	0	0	0	0	0	0.024	0	0.039
	C ₆₅	0	0	0	0	0	0	0.100	0	0.258	0	0	0	0	0	0	0.131	0.073	0	0.194	0	0.105	0	0	0.032	0.052	0

which is column stochastic and represents the final weights w_{ANP} :

$$w_{ANP} = \begin{matrix} & \text{Goal} \\ C_{11} & 0.014 \\ C_{12} & 0.033 \\ C_{21} & 0.038 \\ C_{22} & 0.059 \\ C_{23} & 0.018 \\ C_{24} & 0.018 \\ C_{31} & 0.102 \\ C_{32} & 0.120 \\ C_{33} & 0.018 \\ \mathbf{C_{41}} & \mathbf{0.126} \\ \mathbf{C_{42}} & \mathbf{0.150} \\ C_{51} & 0.016 \\ C_{52} & 0.007 \\ C_{61} & 0.007 \\ C_{62} & 0.000 \\ C_{63} & 0.101 \\ C_{64} & 0.050 \\ \mathbf{C_{65}} & \mathbf{0.123} \end{matrix} \quad (9)$$

Step 3 (calculate the weight of alternatives in each of the sub-criteria). Table 8 presents the pairwise comparison matrices for level 3 subcriteria (C_{11}) in order to compute the weights of the three alternatives.

Similarly, the remaining relative weights of level 3 subcriteria and alternatives can be obtained by pairwise comparison matrices, as presented in Table 9.

Step 4 (calculate the travel risk values of alternative itineraries). The composite priorities of the alternatives are then determined by aggregating the weights throughout the hierarchy. The composite priorities of the alternatives are

$$\begin{matrix} & C_{11} & C_{12} & C_{21} & C_{22} & C_{23} & C_{24} & C_{31} & C_{32} & C_{33} & C_{41} & C_{42} & C_{51} & C_{52} & C_{61} & C_{62} & C_{63} & C_{64} & C_{65} \\ A_1 & 0.247 & 0.271 & 0.277 & 0.254 & 0.244 & 0.347 & 0.054 & 0.093 & 0.068 & 0.049 & 0.047 & 0.335 & 0.383 & 0.231 & 0.059 & 0.268 & 0.333 & 0.333 \\ A_2 & 0.264 & 0.487 & 0.277 & 0.357 & 0.329 & 0.381 & 0.338 & 0.306 & 0.356 & 0.374 & 0.477 & 0.459 & 0.370 & 0.313 & 0.426 & 0.347 & 0.333 & 0.333 \\ A_3 & 0.488 & 0.242 & 0.446 & 0.389 & 0.427 & 0.272 & 0.608 & 0.601 & 0.576 & 0.577 & 0.475 & 0.206 & 0.247 & 0.456 & 0.515 & 0.385 & 0.333 & 0.333 \end{matrix} \quad \begin{matrix} 0.014 \\ 0.033 \\ 0.038 \\ 0.059 \\ 0.018 \\ 0.018 \\ 0.102 \\ 0.120 \\ 0.018 \\ \mathbf{0.126} \\ \mathbf{0.150} \\ 0.016 \\ 0.007 \\ 0.007 \\ 0.000 \\ 0.101 \\ 0.050 \\ \mathbf{0.123} \end{matrix} \quad (10)$$

$$= \begin{bmatrix} 0.174 \\ 0.365 \\ 0.461 \end{bmatrix}.$$

Therefore, the rankings of the travel risks values from applying this approach are Tokyo, GPT A_1 (0.174); Hong Kong and Macau, GPT A_2 (0.365); and Guangxi Guilin, GPT A_3 (0.461). This was based on the lowest coefficient having minimum travel risks in the empirical study. Thus, the best selection for a freelancer is Tokyo GPT (A_1).

4.2. Discussion. These findings indicate that the freelancer will first consider the perspective of the travel risk and further evaluate whether the tour group being considered has enough size and niches for the development of a travel risk evaluation

model. From a long-term perspective, the freelancer may have to consider whether they can continually earn a profit in the tour group in the future. They have a responsibility to their tour groups to make more profit for the travel agencies involved. The second important concern of freelancers is their attitudes. The right work attitude can help freelancers to enjoy greater competitive advantage and reduce the potential travel risk in their tour group. Furthermore, freelancers can learn how to obtain more benefits, such as oral rewards, gifts, or extra tips. Based on the empirical results, TYO GPT (A_1) has the lowest value of travel risks among the three alternatives. Consequently, it can be regarded as a reference template

TABLE 8: Pairwise comparison matrices for subcriteria (C_{11}) to compute the weights of three alternatives.

C_{11}	TYO GPT (A_1)	HKG GPT (A_2)	KWL GPT (A_3)	Weights
TYO GPT (A_1)	1	0.934	0.506	0.247
HKG GPT (A_2)	1.070	1	0.541	0.264
KWL GPT (A_3)	1.977	1.847	1	0.488

$\lambda_{\max} = 3.000$; CI = 0.000; and CR = 0.000 $\leq$ 0.1 consistency.

TABLE 9: The aggregate weights of pairwise comparison matrices for subcriteria of level 3 and alternatives.

Alternatives	Subcriteria of level 3																	
	C_{11}	C_{12}	C_{21}	C_{22}	C_{23}	C_{24}	C_{31}	C_{32}	C_{33}	C_{41}	C_{42}	C_{51}	C_{52}	C_{61}	C_{62}	C_{63}	C_{64}	C_{65}
A_1	0.247	0.271	0.277	0.254	0.244	0.347	0.054	0.093	0.068	0.049	0.047	0.335	0.383	0.231	0.059	0.268	0.333	0.333
A_2	0.264	0.487	0.277	0.357	0.329	0.381	0.338	0.306	0.356	0.374	0.477	0.459	0.370	0.313	0.426	0.347	0.333	0.333
A_3	0.488	0.242	0.446	0.389	0.427	0.272	0.608	0.601	0.576	0.577	0.475	0.206	0.247	0.456	0.515	0.385	0.333	0.333

for freelancers developing the travel risk itinerary evaluation model.

4.3. Practical Management Implications. This study provides freelancers who wish to evaluate travel risk and select a travel agency tour group with a process involving the use of an algorithm. The ultimate goal for a freelancer evaluating a GPT itinerary selection can be achieved, as illustrated in Figure 3, by following six evaluation criteria and 18 evaluation subcriteria. The results of this study offer the following practical management implications and travel risk evaluation strategies for freelancers and other tour leaders who wish to improve their performance around travel risks. In considering the criteria and subcriteria weights, we found “transportation risk,” “financial risk,” and “social risk” to be the three most important criteria. Three subcriteria, the possibility of infectious diseases, a hotel’s security system, and the hygiene of the catering facilities, are highly important.

When tour operator managers seek to assign a group tour to a freelancer, at the same time, the freelancer also evaluates the benefit of that group tour. This indicates that travel agency managers should expend more efforts on a freelancer tour group service, risk control mechanisms, and customer confidence either simultaneously or subsequently. Hence, first, the freelancer could choose the truly important criteria and subcriteria for concept-based model for evaluating the travel risk of a GPT rather than only rely on their working experiences or a traditional evaluation angle. Finally, they can formulate the best group tour business evaluation strategies before the tour group assignment.

5. Conclusions

The proposed model adopts the NGT to identify suitable evaluation criteria and subcriteria for evaluating travel risks and also uses ANP approach to weigh those criteria’s set.

Based on the six evaluation criteria and 18 subcriteria of the research model, three famous GPT cases are used as examples of how to select the lowest travel risk in Taiwan using the proposed model. The empirical results reveal that the Tokyo (TYO) itinerary has the lowest travel risk value and that the Guangxi Guilin (KWL) itinerary has the highest value among the three evaluation cases.

The number of overseas tourists is rising which reveals the bountiful business opportunities in travel industries. Therefore, for freelancers, evaluating the travel risk and then selecting the best GPT itinerary not only contribute to their business development but also reduce the environmental and psychological pressure on them. In this study, the group size, tour durations, and earnings were assumed to be in the same condition as in the cases of alternative GPTs. We propose and explain a compromise ranking method in-depth understanding of the evaluation approach for GPT travel risks. The proposed model has been usefully applied to an empirical study. The results of this analysis should help freelancers to decide how to implement their GPT escort and evaluation strategies more effectively. Future researcher can use the basic concept of the ANP method and combine it with TOPSIS (Total Order Preference by Similarity to the Ideal Solution) technique for extending the ANP method to evaluate the rankings and improve the gaps of performances for achieving the desired/required values (goals).

Competing Interests

There are no competing interests related to this paper.

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