Scenarios Analysis of Tourism Destinations

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Abstract: This study describes a multi-criteria decision-making framework employed to evaluate and rank three tourism destinations, located in the northern and central Greece. Additionally, innovatory elements are the incorporation of differing levels of socioeconomic data (destination image and destination personality) within the decision framework and the direct determination of the PROMETHEE II preference thresholds. The developed methodology provides a user-friendly approach, promotes the synergy between different stakeholders, and could pave a way towards consensus. The main aim of this study was to describe the design implementation and use of a Decision Support System (D.S.S), which applies new methodological approaches for the evaluation and ranking of several tourism destinations.

Key words: Decision support system, destination image, destination personality, multicriteria

INTRODUCTION

The selection among various tourism destinations is a laborious task involving numerous players, conflicting priorities with separate weights, and different scenarios. This complexity of tourism planning and tourism projects in particular makes multi-criteria analysis a valuable tool in the decision-making process. A number of conflicting factors, regional, economic, environmental, risk, social, etc., must be taken into account each time, whereas different groups of decision makers (DMs) get involved in the process. Each group brings along different criteria and points of view, which must be resolved within a framework of understanding and mutual compromise.

Studies on destination image began in the early 1970s, when Hunt's[1] influential work examined the role of image in tourism development. Since then, destination image has become one of the dominant areas of tourism research. Destination image is defined as an attitudinal concept consisting of the sum of beliefs, ideas and impressions that a tourist holds of a destination[2]. An increasing number of researchers support the view that destination image is a multidimensional construct comprising of two primary dimensions: cognitive and affective[3]. The cognitive component can be interpreted as beliefs and knowledge about the physical attributes of a destination, while the affective component refers to the appraisal of the affective quality of feelings towards the attributes and the surrounding environments[4].

Destination image is a widely investigated topic, but the application of brand personality to tourism is relatively new. In the consumer behaviour literature[5], defines brand personality as "the set of human characteristics associated to a brand". Aaker[5] provided evidence for the validity of the brand personality construct through a scaling procedure. The Brand Personality Scale (BPS) consists of five generic dimensions: sincerity, excitement, competence, sophistication and ruggedness. Since then, Aaker's[5] study has been replicated using various consumer brands within different product categories and across different cultures[6,7]. However, to date, research on the application of the BPS to places and tourism destinations has been sparse. Adapting Aaker's[5] research, we view destination personality as a multidimensional construct and is defined as "the set of human characteristics associated to a tourism destination".

Although the use of Multi-criteria Decision Aid (MCDA) techniques has a long history in tourism research has been intensified in the past decade with the raising awareness of destination image issues. Much attention has been paid to Multi-Criteria Evaluation (MCE) approaches to determine management alternatives for complex tourism systems. As the decision making tasks increase, researchers have observed systematic discrepancies between rational theory and actual behaviour. In other words, given the choice between management alternatives, people will not consistently select the "best" alternative based on the evaluation criteria. Evidence suggests that experts in tourism management have great difficulty in intuitively combining information in appropriate ways[8]. Because of limitations in the intuitive decision making process, analytical methods can be used to help determine the worth of multi-attributed alternatives.

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As conflicts between different groups (companies, agencies, etc.) interested in determining management strategies for public resources increase, multi-criteria analysis has become an essential technique for comparing alternatives in business, industry, and government. Multi-criteria analysis is a methodology for ranking management alternatives based on evaluation criteria, weighted by the user. Multi-criteria analysis provides a rational methodology for decision making in the face of uncertainty. It enables the decision maker to choose among alternatives. Unfortunately, choosing among Multi-Criteria Evaluation Methods (MCEMs) to rank multiple attribute alternatives is critical not only because each method produces different rankings[9], but also choosing a methodology is subjective, based upon the predisposition of the Decision Maker (DM)[10].

Several studies have evaluated MCEMs with a variety of criteria for experimental comparisons. Hobbs[11], in a comparative study of power plant sites, identified four criteria which can be used to compare and evaluate MCEMs: (1) theoretical validity, (2) flexibility, (3) results compared to other methods, and (4) ease of use and understanding by the decision maker. It seemed to Hobbs[11] that choosing a MCEM was, in and of itself, a multi-objective problem. Hobbs[11] also concluded that the most appropriate MCEM is very dependent on the specific problem under consideration. Duckstein *et al.*[12] evaluated different MCEMs in a planning study of the Tucson river basin. A comparison of the MCEMs was made with the following criteria: (1) type of data required (i.e. qualitative or quantitative); (2) nature of alternative systems which can be analyzed (i.e. whether or not they can be classified as discrete or continuous); (3) consistency of the results between methodologies; (4) robustness of results with respect to changes in parameter values; (5) ease of computation; and (6) the amount of interaction required between the DM and system analyst (or whoever is applying the MCEM). The study concluded that the methodology of evaluating MCEMs could be extended to include more techniques, evaluation criteria, or other applications.

A comparative study of three different MCEMs[10] utilized four criteria to distinguish between MCEMs when applied to a nuclear power plant sitting: appropriateness, ease of use, validity, and sensitivity of results. The most important conclusions were: (1) the decisions can depend on the choice of methods, even on such theoretically irrelevant factors such as the phrasing of questions, (2) users would be prudent to apply more than one method, and (3) researchers need to broaden their theories of decision making so that such "theoretically irrelevant" factors can be explained, predicted, and controlled. Goicoechea *et al.*[13] conducted an experimental evaluation of four MCEMs, for application in water resources planning, by two different groups. One group consisted of experienced

U.S. Army Corps planners, and the other group was graduate students. Based on a series of non-parametric statistical tests, the results identified that one of the methods was preferred by both groups due to its ease of use and understand-ability.

Hobbs *et al.*[14] extended his research from his 1979 and 1986 works to include two important conclusions: (1) experienced planners generally prefer simple, more transparent methods, and (2) the ranking of alternatives can be more sensitive to the MCEM used than to which person applies it. Finally, Tecle[9] evaluated 15 MCEM techniques to find the most appropriate method for watershed resources management problems. The evaluations were based on four types of criteria: problem related, decision-maker related, technique related, and solution-related. It was concluded that the ranking of MCEMs can be different according to particular problems. Also, it is possible to find different ranking of the various MCEMs based on the experiences of other analysts.

It is becoming increasingly clear that the ranking of different alternatives using an MCEM is dependent on both the method chosen and the predisposition of the DM[14]. Accordingly, it seems that for every application of the MCE methodology, there is a need for experimental tests to select an MCEM. A number of MCEMs should be selected first according to their theoretical validity, and then a comparison between the methods should be made according to specific criteria. These criteria must take into consideration the specific project, including input from professionals and the public. The final choice of methods must render a method with a level of comprehension readily understood by technical and non-technical professionals alike. Lately many D.S.S. systems for rural applications have been developed in Greece.

In this study we develop an integrated, dynamic framework for ranking three tourism destinations based on PROMETHEE II[15]. The main aim of this study is to describe the development, the design implementation and the usage of a Decision Support System (DSS) that takes into account some tourism image and tourism personality data according the selected tourism destinations in order to evaluate and rank them. The DSS uses multicriteria analysis and applies new methodological approaches in order to carry out the evaluation and ranking of the dedtinations. A DSS is a content-free expression; that is, it means different things to different people[16]. It is a computer-based support system for the management decision makers who deal with semi-structured problems[17]. A DSS interacts with the user in order to provide decisions. The DESDESSYS (DEStination DEcision Support SYStem) utilizes some socio-economic ratios that express the main image and personality characteristics of the specific tourism destinations. Following, special weights were assigned to each socioeconomic ratio to give an orientation to the evaluation. Equal weights

were used to perform an overall evaluation, while higher weights were assigned to some ratios when a validation from a socioeconomic point of view was required.

RESEARCH DESIGN

The measures for all the constructs in the study were drawn from previous research. Destination image was operationalised in terms of both its affective and cognitive components. Affective image was measured on a 7-point scale using 4 bipolar items adopted from Russell[18]. The cognitive image measure was adapted from Ong and Horbunluekit's[19] study, and consisted of 17 bipolar adjectives on a 7-point scale.

Destination personality was captured using Aaker's[5] five dimensional brand personality scale (BPS). At a preliminary stage, the BPS 42 personality traits were tested for content validity[20]. Some items were redundant, because they were not suitable to define a tourism destination. A final set of 27 items, split across 5 dimensions, was retained. The items were measured using a 5-point Likert type scale, with anchors (1) not descriptive at all and (5) extremely descriptive, consistent with Aaker's[5] study. Multiple dependent measures were included to assess the criterion validity of the scales[20]. Overall, destination image was measured using a 7-point scale, with anchors (−3) extremely poor and (+3) extremely good. Finally, intention to recommend was measured on a 7-point scale, anchored with (−3) extremely unlikely and (+3) extremely likely[21].

The study was carried out, during July and August 2005, in three different tourism destinations in the northern and central Greece via a personally administered questionnaire. The first area, around the first destination (Chalkidiki), was divided into five sub-areas. The second area, around the second destination (Pilio), was divided into four sub-areas and finally the third area, around the third destination (Katerini), was divided in to three sub-areas. These sub-areas were selected due to their distance from each destination, similar tourism practices, accommodations and climatic conditions. Randomly approached participants were instructed to recall their experiences about the most recently visited tourism destination outside the northern Greece within the last three months. A total of 933 usable questionnaires were collected from Greek nationals. The sample was 47% male, 53% female and, in terms of age group, 17% were between 16 and 24, 25% were between 25 and 34, 28% were between 35 and 44, and 30% were 45 or above. Fifty-five percent travelled to a European country, which can be explained by the ease of travel across the European Union. England and France are the two most popular European destinations, with 24% and 13%, respectively. A large proportion of respondents (42%) were first-time visitors.

THEORETICAL FRAMEWORK

Modeling is the premier phase of the development of a DSS and it consists of three sub-phases. The intelligence phase, the design phase and the choice phase. In the first stage, the intelligence phase, the reality was examined, the problem was defined and data was gathered. In the design phase, the PROMETHEE II methodology (relevance superiority) was chosen to be applied[22]. Six different types of general tests were used to determine the superiority between two alternative solutions, destination X_i over destination X_j. The type of general level test criterion has selected to be used with the corresponding criterion function, because it has an indifferent area, for the determination of the superiority[23]. The general criterion was applied, due to the fact that it does not make use of a strict choice. In the choice phase, a general planning for the implementation of the Software was performed. The system was developed by the use of an Object Oriented Expert system shell, which is an integrated environment for the construction of intelligent systems. Actually, an Executable Knowledge Base was developed which runs automatically. One of the most important aspects of the system is that it provides a full Explanation facility that informs the user about the reasoning process. In other words, the system explains to the user how and why it reached a certain goal. This is an important characteristic of a successful DSS.

The system was developed using the Expert System Shell (ESS) Leonardo by Bezant ltd. It is an object-oriented integrated environment that uses mainly "if … then" rules and of course rule sets in order to store the underlying knowledge. All of the objects used have a corresponding frame that includes all of the object's properties. The system supports classes of objects and even inheritance and multiple inheritances[24]. Methods are applied on the objects to perform various operations. Actually, the DSS has a specific Inference Engine that leads to the goal. The main rule set can be seen, constructed, or modified with the rules free command and it starts with the command "seek goal". Then the Inference Engine can work in three different ways developing on the user's chooses. If the user chooses to execute backwards the Inference Engine starts from the goal and moves backwards firing the necessary rules. The forward chaining approach starts firing each rule till it reaches the goal. The first approach is much faster than the second (from the reasoning point of view) but the second is much faster for the data gathering. That is why the system was built to run in a default way by using backwards chaining with opportunistic forward. In this way it has a very fast reasoning mechanism and it is also fast gathering. It is important that the DSS asks only the necessary questions.

The only limitation of the system's interaction with the user is that it is text driven (due to the nature of the

ESS) that was used. The choices are done using the arrow-keys from the keyboard and the mouse is not used at all. The user has to press enter after each choice. The user has to type the word "Leorun" which is the environment for the execution of all the knowledge bases that have been build in Leonardo. The extension in the name of each executable version of the knowledge base is RKB. The knowledge base runs automatically after the word "Leorun" was typed. Afterwards the user is prompted to input the number of tourism destinations and the number of ratios and used. The second screen prompts for the names of the destinations and the third screen is the ratios and weights input screen. After the input of the data the results screen appears with the destinations in descending order of net flows. Their net floes also appear to the right side of their names.

MATERIALS AND METHODS

The proposed methodology is based on the outranking method PROMETHEE II. This technique has all the advantages of the outranking methods, combined with ease of use and decreased complexity. It performs a pair-wise comparison of alternatives in order to rank them according to a number of criteria. The PROMETHEE II method is the most appropriate for the decision-maker since it provides him with tools enabling him to progress in finding a solution to a decision problem where several, often conflict multiple criteria must be taken into consideration. It is known to be one of the most efficient and simplest multicriteria methods. It is based on the outranking relations' concept, which was found and developed by Roy[25].

In the testing phase, each tourism destination is compared to the others in pairs. In this way, the destinations are tested in the form (v_i, v_j), for i=1,2 (i indicates the order of the destination that is compared to the other two) and j=1,2 (j also indicates the order of the destination but its value ranges from 1 to 2 except the value of i), to determine which one v_i or v_j has the superiority according to the ratios. The H(d) Equation (1) was used to express the superiority (P (v_i, v_j) and P (v_j, v_i) are the functions of preference). The value of variable d is the difference between the ratios of each pair of destination$_1$/ destination$_2$ (v_i, v_j), as descried by Brans and Vincke[23].

$$H(d) = \begin{cases} P(v_i, v_j) \\ P(v_j, v_i) \end{cases} \text{Sub-eriority of destination } v_i$$

and v_j, if d≥0 or d<0 respectively (1)

The H(d) can take values according to the following Equation (2), the level criterion equation. It should be mentioned that p and q are parameters that usually have a fixed value.

$$H(d) = \begin{cases} 0 & \text{if} \quad IdI \le q \\ 1/2 & \text{if} \quad q < IdI \le p \\ 1 & \text{if} \quad p < IdI \end{cases}$$ (2)

The q and p parameters were partly estimated by the system and they do not have a fixed value. The estimation of p and q was performed as follows. First, the annual performance of the three destinations was calculated for each ratio. If there was a destination with a very high value of performance, clearly much higher than that of the other two destinations, it was excluded for the ratio under testing to avoid problems that might be caused in the calculation of p and q. Differences d_i (i=1, 2, 3, 4 and 5) were calculated for every pair of destinations examined for each ratio. In each case the preference function took into consideration only the absolute values of d_i. Afterwards, the range E between the max and the min values of d_i was calculated, using Equation (3), while q and p were estimated using the following Equations (4) and (5), respectively.

$$E = d_{max} - d_{min}$$ (3)

$$q = d_{min} + \lambda * E$$ (4)

$$p = d_{min} + \mu * E$$ (5)

The coefficients λ and μ were considered to be threshold values used for the estimation of p and q, respectively. Both λ and μ were assigned specific values, depending on the type of the problem and on the degree of sensitivity of the superiority control. In this case, λ was assigned the value of 0.2 and μ the value of 0.4. In this way, the q and p were calculated for each criterion and for each year.

The multicriteria indicator of preference $\Pi (v_i, v_j)$, which is a weighted mean of the preference Equations $\Pi (v_i, v_j)$ with weights defined by the researcher, expresses the superiority of the destination vi against destination vj after all the ratios are tested. The values of Π were calculated using the following Equation (6)[15].

$$\Pi(v_i, v_j) = \frac{\sum_{t=1}^{k} W_t * P_t(v_i, v_j)}{\sum_{t=1}^{k} W_t}$$ (6)

It should be mentioned that k is defined to be the number of ratios (k=8) and $P_t (v_i, v_j)$ the preference functions for the k ratios. The multicriteria preference indicator $\Pi(v_i, v_j)$ takes values between 0 and 1. When two destinations (v_i, v_j) are compared to each other every one is assigned two values of flows, the outgoing flow and the incoming flow. The outgoing flow is calculated by the following Equation (7)[26]:

$$\varphi^+(v_i) = \sum_{v_j \in A} \Pi(v_i, v_j)$$ (7)

In both cases, A is defined to be the number of the alternative solutions destinations v_j (which in this case are three). The outgoing flow expresses the total superiority of the destinations. v_i against all the other destinations v_j for all the ratios The incoming flow is determined by the following Equation (8)[26]:

Table 1: Ranking and net flow calculations (Scenarios 1, 2, 3 and 4)

Destinations	Ranking				Net Flow calculations			
	Scen. 1	Scen. 2	Scen. 3	Scen. 4	Scen. 1	Scen. 2	Scen. 3	Scen. 4
Chalkidiki	1st	1st	2nd	2nd	0.250	0.050	0.010	0.000
Pilio	2nd	3rd	3rd	1st	0.150	-0.100	-0.010	0.050
Katerini	3rd	2nd	1st	3rd	0.125	0.000	0.100	-0.100

$$\varphi^-(v_i) = \sum_{v_j \in ;A} \Pi(v_i, v_j) \qquad (8)$$

The incoming flow expresses the total superiority of all the other destinations against destinations v_i for the ratios. The pure flow for each destination v_i is estimated by the Equation (9) below. The pure flow is the number that is used for the comparison between the destinations in order to obtain the final ranking. Each destination that has a higher pure flow is considered to be superior in the final ranking.

$$\varphi(v_i) = \varphi^+(v_i) - \varphi^-(v_i) \qquad (9)$$

By using the methodology that is described above, the PROMETHEE II contributes significantly towards making an integrated and rational evaluation, assessment and ranking of the performance and viability of the tourism destinations examined in this study, by specifying the impact of all those factors on them.

RESULTS

The estimated characteristics of each destination divided in seven separate categories: affective image-V_1, cognitive image-V_2, sincerity-V_3, excitement-V_4, competence-V_5, sophistication-V_6 and ruggedness-V_7. For the testing phase of DESDESSYS, each ratio is assigned a certain weight. Considering that seven ratios are examined, obviously seven weights W_i (i=1, 2, 3,…, 7) are used by the system and the sum of the weights equals to one: $\Sigma W_i = 1$. Assigning different weights to specific ratios or groups of ratios, four different what if scenarios were performed. In the first scenario, equal weights are assigned to each ratio (e.g. 0.143), assuming that equal importance is given by each ratio (Table 1).

Studying the information on Table 1, we see that, although "Chalkidiki" is in the 1st position for the 1st only scenario it is obvious that its net flow is too high. The net flows of all the other destinations are comparative lower. That means, tourists believe that the destinations of "Pilio" and "Katerini" will not cause enough positive benefits.

After the initial analysis and the structuring of the problem, weighting factors reflecting possible preferences were assigned[27]. For the purposes of the proposed methodology we developed a computer model enabling the decision maker to introduce the corresponding values of the weighting factors. His choice is visualized in the form of an immediate graphical representation, with the ranking of the destinations displayed in a comprehensible manner (Fig. 1). Since the project was in its initial phase, it was not possible to bring all decision makers together and employ a formal procedure for extracting their preference regarding weight attributes. Therefore, weight factors reflecting the analysts' previous experience and their insights from their involvement in the initial stages of the project were adopted (scenarios 2 to 4). Further work analyzing the real preference elicitation and negotiation procedure could reveal the applicability of such innovative methodological solutions and the way they can be integrated under realistic operating conditions.
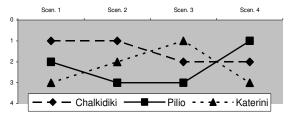

Fig. 1: Ranking according to each scenari

According to the second scenario the affective image's ratio (V_1) were assigned weights equal to 0.2 while those of others ratios (V_2-V_7) were assigned weights equal to 0.1 (Table 1). In the second scenario the "Chalkidiki" destination are in the 1st position although the net flow are sufficiently low. That means tourists believe that the specific destination will cause limited benefits. The other two destinations present negative or zero net flows in the 2nd scenario. In these two areas the opinion of the people is so bad that they obviously believe there will be negative effects or no effects from visiting each specific destination. The difference between the ranking of the first and the second scenario clearly demonstrates the importance of the affective image at the "Chalkidiki" destination (Fig. 1).

According to the third scenario, the cognitive image's ratio (V_2) was assigned weights equal to 0.2. Those of other ratios (V_1 and V_3-V_7) were assigned weights equal to 0.1 (Table 1). In this scenario the "Katerini" destination is in the 1st position although the net flow is equal to 0.1. That means, tourists believe that visiting the specific destination will cause limited benefits. The other two destinations present net flows around the zero or negative. The difference between the ranking of the first and the third scenario clearly demonstrates the importance of the cognitive image at the "Katerini" destination (Fig. 1).

Finally, according to the fourth scenario, the destination personality ratios (V_3-V_7) were assigned weights equal to 0.2. Those of destination image ratios (V_1-V_2) were assigned weights equal to 0.1 (Table 1). In this scenario the destination of "Pilio" is in the 1st position presenting net flow equal to 0.05. That means, tourists believe that visiting the specific destination will cause sufficiently low benefits. The other two destinations present negative or zero net flows. The difference between the ranking of the first and the fourth scenario clearly demonstrates the destination personality sentience of the tourists who choose the destination of "Pilio" (Fig. 1).

CONCLUSION

The DESDESSYS Decision Support System could play a very important role not only in evaluating each tourism destination, separately, but the destinations collectively as well. With the application of different "what….if" scenarios it can evaluate the destination benefits from many different aspects and provide useful information for the decision making process. This is a very difficult error prone and time-consuming task for humans. All the classical methods of socio-economic ranking and evaluation use a vast amount of data, and they perform a long series of calculations bringing the human capabilities of reasoning and inferring to their limits.

On the other hand, in the testing phase, DESDESSYS has proven to be very effective. The explanation mechanism of DESDESSYS justifies the final outcome and in this way the end-user feels confident that the obtained result is accurate. This is really important for the system to gain acceptance in the scientific community. Something really important is that the system could be applied not only in the tourism destinations but also in other branches of tourism sector that require socio-economic evaluation and cases where the peoples' opinion is required. It has been already understood that he appropriate DSS tools could be very important for effective decision-making.

Obviously the DESDESSYS is one of the major keys that tourism destinations should use in the scheduling of a more rational and effective management policy. A very interesting project would be the re-evaluation of the destinations after they have started their operation. It would be interesting if the people would still have the same opinions as before their operation. The system eliminates all of these problems and limitations and it starts a new era for the management of tourism destinations. A future extension to the system can be done. A new version of DESDESSYS would be able to handle larger number of tourism destinations or characteristics.

The results of this study can be proved useful to both policy makers and individual tourists or tourism operators. Policy makers will be able to assess the feasibility of changing tourism destinations rights to meet the demands of various tourism needs and the subsequent impact on tourists. On the other hand, tourists and tourism operators will be able to quantify the relationship between the destination supply and their income, and have a clearer understanding of the consequences of any agreement that would affect the status of the current accommodation supplies.

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