Full Length Research Paper

A study of the key success factors of the ecotourism industry in Taiwan

Meng Shiunn Lee¹, Ya Han San² and Yu Ru Hsu¹*

¹Department of Business Administration, Chang Jung Christian University, 396, Sec.1, Chang Jung Road., Kway Jen, Tainan 711, Taiwan.
²Department of Business Operations Management, Chang Jung Christian University, 396, Sec.1, Chang Jung Road., Kway Jen, Tainan 711, Taiwan.

Accepted 6 October, 2010

The Taiwanese ecotourism sector is starting to develop. Significant challenges lie in the balance between achieving a competitive sector whilst maintaining a sustainable resource. Taking the Taiwan ecotourism industry as the field of research, a set of possible key success factors in the ecotourism industry was developed based on Porter’s value chain (Porter, 1985). The key success factors in this industry were developed through an expert questionnaire survey and analyzed using the Fuzzy Delphi Method and Fuzzy Analytic Hierarchy Process. As a consequence, this study is able to present six key success factors related to development of competitive advantage in the ecotourism industry in Taiwan. Based on these findings, a set of specific development strategies are proposed.

Key words: Ecotourism industry, value chain, competitive advantage, key success factor, development strategy.

INTRODUCTION

At present, there are many different definitions of ecotourism. Through integration of relevant literature (Cardenas-Torres et al., 2007; Clifton and Benson, 2006; Gifford et al., 2007; Laurance et al., 2006; Lindsey et al., 2007; Valentine et al., 2004; Ceballos-Lascurain, 1987; Pacific Asia Travel Association, 1991; Stewart and Sekartjakrarini, 1994; Tourism Bureau, Ministry of Transportation and Communications, 1997; Peng and Mao, 2004), this study defined the ecotourism industry as:

The travel built on the basis of natural resources, humane history, and geographical relics while taking environment protection, environment education, and local profit as its final objective with the aim to achieve permanent development.

The development of ecotourism in Taiwan can be traced back to the 1980s. Since the establishment of the national parks, the Tourism Bureau of Taiwan has begun to organize narrative and travel activities to those areas. In the 1990s, as part of the process of international development, the national parks and the folk ecology protection organizations began to promote the concept of recreation with a focus on environment protection using the vehicle of exposure to natural experiences and ecological narratives. After 1995, a small group who were engaged in tourism began promoting ecotourism tour packages. However there was little to associate these packages to ecotourism as given in the definition above. It was only in 2000 that the Tourism Bureau (within the Ministry of Transportation and Communication) made clear that ecotourism was one of the most important directions for development of tourism in Taiwan.

The government has actively promoted ecotourism industry and as a result it has developed rapidly. However, the negative impact resulting from it has also emerged rapidly especially since people having little understanding of ecology and in particular environment protection behavior. Moreover, with the development of the economy and increases in the population have resulted in environment pollution, climatic variation, disappearance of biological habitat, and consequently, the local ecological environment has faced a reduction of biological diversity and the deterioration of ecosystem. Although various types of species currently exist in Taiwan,
however this number is liable to reduce if they are not adequately managed. Hence, the critical success factors to achieve success in this industry must be found out in order to create an ecological landscape in Taiwan. With the setting up of landscape conservation zones in different parts of Taiwan and the increasing numbers of ecological tourist spots, then thought needs to be given as to how to operate and manage the ecotourism industry. Ecotourism covers many facets as highlighted in the “The White Paper of Ecotourism” (2004) that includes reference to tourists, local residents, non-governmental organizations and governmental departments. Therefore, the achievement of balance between these different aspects and the issue of damage to the ecological environment is an important theme in the future sustainable development of ecological tourism and is also the primary focus of this research. Moreover, since competitive advantage of this industry is affected by multiple factors, this research adopted Porter’s (1985) value chain to analyze the key success factors that may affect the competitive advantage of ecotourism industry.

**Competitive advantage of the ecotourism industry**

Crouch and Ritchie (1999) suggested that the competitiveness of a tourist spot was attributable to four main factors: (1) support factors and resources including firm infrastructure, accessibility, promotional resources, and enterprise; (2) core resource and its attraction including topography, history and culture, market relationships, integrated activities, special festivals and constructions; (3) management of the tourist spot including resource management, marketing, organization, consultation and service; (4) qualifying criteria including local and surrounding environment, safety, and cost. Mihalic (2000) explored the competitive advantage of a tourist destination from the perspective of environmental management and the findings showed that the tourist spots would be affected by environmental impact as well as environmental quality, and that the competitiveness of the tourist spots could be boosted by effective marketing activities.

Hawkins (2004) identified the development strategies for both the protection of ecotourism areas and the development of the economy. The results were developed through a study of a plan centered on national competitive advantage, biodiversity conservation and economic growth (BCEG), as proposed in Porter’s study. The plan included the: (1) development of the interested organizations; (2) promotion of education leading the society to approach the protected area; (3) reinforcement of law and management organization; (4) increase of opportunities for firms to exert their entrepreneurial spirit; (5) reinforcement of the capability of social objective management; (6) connection between the protected area and the area with few visitors; (7) implementation of environmental management and evaluation procedures; (8) increase in budget provided to the protected area; (9) expansion of the brand name by means of networking; and (10) development of signs and monitoring systems. It appears that no prior research has adopted Porter’s value chain model to examine the critical success factors for competitive advantage in the ecotourism industry. Having reviewed the relevant literature, this study proposed an initial framework specifically to address the characteristics of the ecotourism industry (Table 1). This framework would then be used as the basis for the development of a primary hierarchical structure (Figure 3) and to facilitate subsequent empirical investigation.

**Value chain and competitive advantage**

To analyze the specific activities through which a firm can create a competitive advantage, it is useful to model the firm as a chain of value-creating activities. Porter (1985) identified primary and support activities in the model as depicted in Figure 1. The primary value chain activities include inbound logistics, operations, outbound logistics, marketing and sales, as well as service. The support value chain activities include infrastructure, human resource management, technology development, and procurement. The goal of these activities is to offer the customer a level of value that exceeds the cost of the activities, thereby generating a profit margin. According to Porter (1985), the content of the value activities could be changed to fit different industry characteristics. Therefore, this study started by using the characteristics of the ecotourism industry to develop a revised and representative value chain model in terms of six measurement dimensions related to the critical success factors for competitive advantage of ecotourism industry. These were: firm infrastructure and management, product or technical development, human resources, local resources, marketing activity, the service system and cultivation of tourists’ concept and behavior (Figure 2).

In Porter’s model, inbound logistics is concerned with materials handling. In the case of ecotourism industry, the materials may include natural environment, local culture, and so on. Thus, this study labeled inbound logistics as “local resources”. Operation is concerned with the transformation of raw materials to the final products. In the case of the ecotourism industry, the final product is the service provided to customers. With regard to outbound logistics, since the ecotourism industry mainly attracts tourists by virtue of the destinations’ natural resources and local features, the outbound logistics in ecotourism industry is not remarkable. Marketing and sales referred which products are delivered to the customers (tourists). Hence, this study named this stage as “marketing activity”. Finally, service lays an emphasis on the promotion and maintenance of product quality, and given the importance of development tourists’ concept of conservation and management of their behavior, this study labeled this
**Table 1. Initial dimension framework.**

<table>
<thead>
<tr>
<th>Measurement dimension</th>
<th>Assessment criterion</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm infrastructure and management</td>
<td>Completeness of public facilities</td>
<td>Safety of hardware equipment</td>
</tr>
<tr>
<td></td>
<td>Attraction of recreation facilities</td>
<td>Capacity of operating teams</td>
</tr>
<tr>
<td></td>
<td>Price and convenience of accommodation</td>
<td>Leadership style of operating teams</td>
</tr>
<tr>
<td></td>
<td>Completeness of signs and monitoring systems</td>
<td>Management of environmental quality</td>
</tr>
<tr>
<td></td>
<td>Management of tourist Spot</td>
<td>Convenience of catering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capability of environmental planning</td>
</tr>
<tr>
<td>Marketing activities</td>
<td>Low-price promotion strategy</td>
<td>Product diversity</td>
</tr>
<tr>
<td></td>
<td>Comprehensiveness of package tours</td>
<td>Advertising promotion</td>
</tr>
<tr>
<td></td>
<td>Product diversity</td>
<td>Overall environmental image and reputation</td>
</tr>
<tr>
<td></td>
<td>Trip design</td>
<td>Market segmentation and selection</td>
</tr>
<tr>
<td></td>
<td>Image re-orientation</td>
<td>Marketing channels</td>
</tr>
<tr>
<td></td>
<td>Consuming capacity of tourists</td>
<td>Convenience of connected traffic</td>
</tr>
<tr>
<td>Industrial environment</td>
<td>Promotion of central and local units</td>
<td>Degree of inter-industry integration</td>
</tr>
<tr>
<td></td>
<td>Participation and support of public departments</td>
<td>Promotion degree of education</td>
</tr>
<tr>
<td></td>
<td>Development of the interested organizations</td>
<td>Combination of local culture and tourist resources</td>
</tr>
<tr>
<td></td>
<td>Revision of decrees and policies</td>
<td>Integration of features of adjacent towns and villages</td>
</tr>
<tr>
<td></td>
<td>Financial budget of protected area</td>
<td>Convenience of connected traffic</td>
</tr>
<tr>
<td>Local resources</td>
<td>Characteristics of human ecology</td>
<td>Location’s conditions</td>
</tr>
<tr>
<td></td>
<td>Utilization of local resources</td>
<td>Degree of abundance of tourist resources</td>
</tr>
<tr>
<td></td>
<td>Participation and identity of residents</td>
<td>Features of local life</td>
</tr>
<tr>
<td></td>
<td>Maintenance capacity of community</td>
<td>Features of local resources</td>
</tr>
<tr>
<td></td>
<td>Core resource and its attraction</td>
<td>Environmental attraction</td>
</tr>
<tr>
<td>Development and innovation</td>
<td>Innovation of recreation facilities</td>
<td>Design and development of innovative projects</td>
</tr>
<tr>
<td></td>
<td>Innovation capacity of activities</td>
<td>Development of hardware equipment</td>
</tr>
<tr>
<td></td>
<td>Development of commercialized products</td>
<td>Appropriateness of catering</td>
</tr>
<tr>
<td></td>
<td>Product quality and characteristics</td>
<td></td>
</tr>
<tr>
<td>Service</td>
<td>Attitude of waiters</td>
<td>Professional service</td>
</tr>
<tr>
<td></td>
<td>Responsiveness of waiters</td>
<td>Guiding capacity of narrators</td>
</tr>
<tr>
<td></td>
<td>Customer service system</td>
<td>Special and high-quality service</td>
</tr>
<tr>
<td></td>
<td>Specialized skills of narrators</td>
<td>Customer satisfaction</td>
</tr>
</tbody>
</table>

stage as “service system and cultivation of tourists’ understanding and behavior”.

In addition, with regard to infrastructure, the ecotourism industry is similar to other enterprises that also require the construction of basic facilities to support the whole value chain. In this case, the emphasis is on the basic facilities for recreation and travel and maintenance of local resources. Hence, this study labeled this stage as “firm infrastructure and management”. In terms of human resource management, the ecotourism industry requires professional personnel for ecological conservation, narration, education and trip planning. This study labeled this stage as “human resources”. Concerning technology development, the emphasis is on the understanding of and development of appropriate parameters for products and activities in the ecotourism industry. This study labeled this stage as “product or technical development”. Considering support activities, no other resource inputs are required since the natural resources and trip planning are the main issues. Consequently “procurement” is an inconspicuous stage in this industry. Finally, margin refers to the final value activity in the value chain. However,
since the ecotourism industry is not profit oriented, this
study adopted sustainable development as the final
objective.

Key success factors

Daniel (1961) pointed out that most industries contain
three to six factors that can determine success and these
should be the focus of business activity for achievement
in the industry (Thompson and Strickland 2002).
Leidecker and Bruno (1984) and Bender et al. (2001)
both believed that key success factors referred to some
specialties, conditions, or variables and through con-
tinuous maintenance and control they can significantly
affect a firm’s degree of competitive success. Therefore,
understanding the key success factors and their potential
for creating competitive advantage in the ecotourism
industry is critical and is the focus of this paper.

Confirmation methods for key success factors

When evaluating key success factors, a variety of
methods have been adopted in previous research,
including factor analysis, the Delphi Method, case study,
hierarchical analysis, Fuzzy Delphi Method, fuzzy hierar-
chal analysis (Bullen and Rockart, 1981; Chen, 2002;
Hofer and Schendel, 1985; Hsu, 1998; Saaty, 1980). In
this case, a survey of experts was used to integrate
various points of different researchers (Hwang and Lin,
According to these researchers, Fuzzy Delphi Method
and Fuzzy Hierarchical Analysis are recognized as
having the following benefits when solving problems
related to group consensus decision-making. A primary
advantage is that the fuzziness and uncertainty of human
thought can be fully analyzed as reflected in the process
of criterion measurement and judgment. The method is
also efficient thereby saving survey time (the set-up
procedure, for example, is straightforward) and whilst
enabling experts’ inputs to be completely incorporated.
Further benefits lie in the fact that fuzzy hierarchical
analysis can help one to get acquainted with the reversion
of the plan, it involves a simple counting
process and is also capable of dealing with multiple-
hierarchical, multiple-property and multiple-plan decision-
making problems.

METHOD

Establishment of a primary hierarchical structure

According to Table 1 and Figure 2, this study established a primary
hierarchical structure for “the key success factors of the competitive
advantage of the ecotourism industry” (Figure 3). This structure was
divided into three hierarchies in turn: the final goal (key success
factors of the ecotourism industry), the main dimensions (primary
and support activities), the assessed elements (firm infrastructure
and management, product or technical development, human
resources, local resources, marketing activity, the service system
and cultivation of tourists’ concept and behavior), and the 38
assessed factors. This structure can also be used as the basis for
design of a Fuzzy Delphi questionnaire.

Questionnaire design and survey objects

In the first stage of the questionnaire design, Fuzzy Delphi Method
was used to design the expert questionnaire. Instructions were given on the first page of the questionnaire. The body of the instrument followed in which the expert respondents were asked to assess both the acceptable scope and the degree of importance of each item. Their assessment was based on a range of 0~10 with 10 signifying the most, and 0 the least important. Open questions followed each question item so that the experts could qualitatively input. In the final section of the questionnaire, basic information related to respondents was collected.

In the second stage of the questionnaire design, this study used the success factors screened out from the first stage in order to establish a complete hierarchical structure which then facilitated the design of the questionnaire by means of Fuzzy Hierarchical Analysis. The questionnaire was composed of the two following main parts: the sequence of importance of assessment criteria and a paired comparison of relative importance of assessment criteria. The assessment was made on a nine point scale (where 1 represented the least important and 9 represented the most important) and adopted the paired comparison method.

In the first stage to make the dimensions more objective, this study adopted a purposive sampling method. Robbins (1994) pointed out that the optimal number of experts required by the group decision-making was between five and seven. A total of 24 expert questionnaires were distributed and 18 were returned. The experts were administrators from the publicly operated units, travel agencies, ecotourism organizations, and professors in the fields of leisure and tourism. In the second stage of data collection, the same sample group was resurveyed (24 surveys distributed and 18 valid responses).

### Method of data analysis

**Fuzzy Delphi method**

In this research, fuzzy theory was integrated into the Delphi Method taking account of current theoretical practices (Hwang and Lin, 1987; Hsu, 1998; Chen, 2001; Lee, 2008). In order to overcome the problems traditionally faced with the Delphi Method, this study adopted bi-triangular fuzzy arithmetic to integrate experts’ data and then subsequently tested the convergent effect by means of the Gray Zone Test Method. The Fuzzy Delphi Method was developed in the following steps:

**Step 1:** Each expert offered a possible interval value for each assessed item. The minimum value of this interval number represented the most conservative perceived value given by the experts as related to the quantitative score of the assessed item. Conversely, the maximum value represented the most optimistic perceived value given to the quantitative score of the assessed item.

**Step 2:** In this step, first conducting a statistical analysis on the data of the “most conservative perceived values” and “the most optimistic perceived values” respectively. Next, remove the extreme values of the data falling outside two standard deviations of the two distributions to avoid unreasonable evaluations by the experts. The minimum value ($C^i$), the geometric mean ($C^m$), and the maximum value ($C^n$) of the most conservative perceived values as well as the minimum value ($O^i$), the geometric mean ($O^m$), and the maximum value ($O^n$) of the most optimistic perceived values were then identified.

**Step 3:** Based on the foregoing steps, the triangular fuzzy numbers of both the most conservative perceived value ($C^i = (C^i_l, C^i_m, C^i_u)$) and the most optimistic perceived value ($O^i = (O^i_l, O^i_m, O^i_u)$) of each assessed item ($i$) was established.

**Step 4:** Finally, the following processes of analysis were used to determine the degree of consensus between the experts about the assessed item. Nonexistence of a gray zone:

Then the following processes of analysis were used to determine the degree of consensus between the experts about the assessed item.

$$C^i_l \leq O^i_l$$

If the two triangular fuzzy numbers of both the most conservative perceived value ($C^i = (C^i_l, C^i_m, C^i_u)$) and the most optimistic perceived value ($O^i = (O^i_l, O^i_m, O^i_u)$) of each assessed item ($i$) do not overlap ($C^i_u \leq O^i_l$), then the experts have a high degree of

### Figure 2. A revised value chain model/dimensions of critical success factors in the ecotourism industry.

![Figure 2](image-url)
Figure 3. A primary hierarchical structure – the key success factors of the competitive advantage of the ecotourism industry.

Consensus on the assessment of the item \(i\) in the questionnaire. Therefore, the value of the importance of degree of consensus \(G^i\) of the assessed item \(i\) equals to the mean value of \(C_m^i\) and \(O_m^i\) and it is represented as:

\[
G^i = \frac{C_m^i + O_m^i}{2}
\]  

Existence of a gray zone due to small divergence of expert opinions

If the two triangular fuzzy numbers of both the most conservative perceived value \(C^i = \left( C_{L}^{i}, C_{M}^{i}, C_{U}^{i} \right) \) and the most optimistic perceived value \(O^i = \left( O_{L}^{i}, O_{M}^{i}, O_{U}^{i} \right) \) of each assessed item \(i\)
was established, a so-called gray zone with a new fuzzy set of triangular fuzzy numbers is emerged due to divergence of expert opinions. If the range of new triangular fuzzy numbers for the gray zone \((Z_i = C_{ij}^{m} - O_{ij}^{m})\) is smaller than the difference \((M_{ij} = O_{ij}^{m} - C_{ij}^{m})\) between the geometric means of the optimistic and conservative perceived values, it represents a valid questionnaire survey for the particular item due to a smaller divergence of expert opinions. The new fuzzy set \(F'((X_j))\) of triangular fuzzy numbers of the gray zone can be formulated as:

\[
F'((X_j)) = \left\{ \min \left[ C_{ij}^{m}(x_j), O_{ij}^{m}(x_j) \right] \right\} dx
\]

Therefore, the value of the importance of degree of consensus \((G')\) of the assessed item \((i)\) is identified as the maximum value of membership \(\mu_{ij}(X_j)\) attributable to the fuzzy set and its fuzzy formulas used is as follows:

\[
G' = \left\{ X_j \mid \max \mu_{ij}(X_j) \right\}
\]

Existence of a gray zone due to large divergence of expert opinions

If the two triangular fuzzy numbers of both the most conservative perceived value \((C_{ij}^{+} = C_{ij}^{m}, C_{ij}^{m}, C_{ij}^{m})\) and the most optimistic perceived value \((O_{ij}^{+} = O_{ij}^{m}, O_{ij}^{m}, O_{ij}^{m})\) of each assessed item \((i)\) have an overlapped area with a range wider than the difference between their geometric means, it represents an invalid assessment on this item due to a larger divergence of expert opinions. Then, the questionnaire survey on this item should be conducted again. Steps 1 to 4 should be repeated to find out “the value of importance of degree of consensus” \(G'\).

In this analysis process, greater levels of consensus are represented by a higher degree of importance being attributed to each item. The arithmetic mean was calculated based on the geometric mean of the most possible single value of each item. This was then adopted as the threshold value to select a suitable number of assessed factors.

Fuzzy analytic hierarchy process (FAHP)

Fuzzy Analytic Hierarchy Process was used to weigh the relationships and evaluate the degree of importance of the different assessed items. The approach involves introduction of fuzzy theory into the Analytic Hierarchy Process developed by Saaty (1980) in order to assess the weights of various assessed items and to sort their importance. This offers us the opportunity to arrive at an objective set of key success factors. In this case, this study combined the approaches of Buckley (1985), Chen (2002), Hsu (1998), and Robbins (1994) to arrive at a robust approach that is given as follows:

Step 1. Establishment of the hierarchy structure: Based on the assessed items arrived at through the Fuzzy Delphi Method, a hierarchical structure consisting of the goal, dimensions, assessed elements, and assessed factors can be established.

Step 2. Establishment of a pairwise comparison matrix: Through the survey data, the opinion of expert \(K\) in Level \(L\) on relative importance of any two assessed items \(i\) and \(j\) in Level \(L+1\) was obtained. This enabled the pairwise comparison matrix \(H\) to be established.

Step 3. Calculation of the triangular fuzzy number: The opinions of experts might be subjective and imprecise. Therefore, triangular fuzzy numbers were used to integrate experts’ fuzzy opinions about the relative importance of any two assessed items \(i\) and \(j\). The related mathematical equations were described as follows:

\[
\hat{h}_{ij} = (\alpha_{ij}, \delta_{ij}, \gamma_{ij}), \quad \alpha_{ij} \leq \delta_{ij} \leq \gamma_{ij}, \quad i,j = 1, 2, \ldots, n
\]

\[
\alpha_{ij} = \min \left\{ B_{ij} \right\}, \quad k = 1, 2, \ldots, n
\]

\[
\delta_{ij} = \left( \prod_{k=1}^{n} B_{ij} \right)^{1/n}
\]

\[
\gamma_{ij} = \max \left\{ B_{ij} \right\}, \quad k = 1, 2, \ldots, n
\]

\(\hat{h}_{ij}\): Triangular fuzzy number of any two assessed items \(i\) and \(j\).
\(\alpha_{ij}\): Minimum of the subjective opinions of experts on relative importance of any two assessed items \(i\) and \(j\).
\(\delta_{ij}\): Geometric mean of the subjective opinions of experts on relative importance of any two assessed items \(i\) and \(j\).
\(\gamma_{ij}\): Maximum of the subjective opinions of experts on relative importance of any two assessed items \(i\) and \(j\).
\(B_{ij}\): The subjective opinion of expert \(K\) on relative importance of any two assessed items \(i\) and \(j\).
\(L-1\): The fuzzy interval of triangular fuzzy numbers

Step 4. Establishment of the Fuzzy positive reciprocal matrix: Triangular fuzzy numbers were used to express the experts’ fuzzy opinions. Hence, a fuzzy positive reciprocal matrix \(\tilde{H}\) was established as described thus:

\[
\tilde{H} = \left[ \hat{h}_{ij} \right], \quad i,j = 1, 2, \ldots, n
\]

\[
\hat{h}_{ij} = (\alpha_{ij}, \delta_{ij}, \gamma_{ij}), \quad \hat{h}_{ij} \times \hat{h}_{ji} = 1, \quad \forall ij = 1, 2, \ldots, n
\]

Step 5. Fuzzy matrix: \(\tilde{H}\) consistency verification: This study assumed the existence of both a positive reciprocal matrix \((H = \left[ h_{ij} \right])\) and a fuzzy positive reciprocal matrix \((\tilde{H} = \left[ \hat{h}_{ij} \right])\) and considered
both a valid judge of the questionnaire data. If experts thought the assessed item i was more important than the assessed item j, then the fuzzy paired comparisons could be calculated as follows:

\[
\hat{h}_{ij} = (\alpha_i, \delta_i, \gamma_i), \quad \alpha_i, \delta_i, \gamma_i \in \{1, 2, \ldots, 9\}, \text{ while}
\]

\[
\hat{h}_{ji} = \left(\frac{1}{\alpha_i}, \frac{1}{\delta_i}, \frac{1}{\gamma_i}\right)
\]

If experts thought the assessed items i and j were equally important, then the fuzzy pairwise comparisons were represented as: \(\hat{h}_{ij} = (1, 1, 1)\).

**Step 6. Calculation of the fuzzy weights for the Fuzzy positive reciprocal matrix:**

\[
\tilde{Z}_i = \left(\hat{h}_{ij} \otimes \cdots \otimes \hat{h}_{in}\right) \frac{1}{n}, \quad \forall i, i, j = 1, 2, \ldots, n
\]

\[
\hat{W}_i = \hat{Z}_i \otimes \left(\hat{Z}_1 \otimes \cdots \hat{Z}_n\right)^{-1}
\]

\[
\tilde{Z}_i : \text{The geometric average of the triangular fuzzy numbers, } \hat{W}_i : \text{The fuzzy weight of the triangular fuzzy numbers}
\]

\[
\hat{h}_1 \otimes \hat{h}_2 \equiv (\alpha_1 \times \alpha_2, \delta_1 \times \delta_2, \gamma_1 \times \gamma_2)
\]

\[
\hat{h}_1 \ominus \hat{h}_2 \equiv (\alpha_1 + \alpha_2, \delta_1 + \delta_2, \gamma_1 + \gamma_2)
\]

\[
\tilde{Z}_1^{-1} = \left(\gamma_1^{-1}, \delta_1^{-1}, \alpha_1^{-1}\right)_{L-K}
\]

\[
\hat{h}_i = \left[\alpha_i^{-1}, \delta_i^{-1}, \gamma_i^{-1}\right]_n
\]

**Step 7. Defuzzification:** Since the weight of the assessed item is represented as a fuzzy value, the single weight value can be obtained using the defuzzification process. For this purpose, this study adopted the arithmetic average method which is represented as:

\[
W_i = \frac{W_m + W_w + W_a}{3}
\]

\(W_m\): The minimum of the fuzzy weight.

\(W_w\): The value of the fuzzy weight with membership value 1.

\(W_a\): The maximum of the fuzzy weight.

\(W_s\): The single value by converting the fuzzy weights.

**Step 8. Normalization of values:** For convenience of comparison, all of the weight values obtained can be normalized so that their sum is 1 and the formula to achieve this is:

\[
NW_i = \frac{W_i}{\sum_i W_i}
\]

**DATA ANALYSIS**

The first phase analysis- Fuzzy Delphi method analysis

In the first phase of analysis, the objective was to establish a hierarchical structure representing a consensus of experts’ opinion. The threshold value of 7.9 was calculated, as described above, in order to act as the screening standard of the assessed factors and the result is shown in Table 2. In this process, 17 assessment items (55% of the total) were deleted and 21 items were remained as possible success factors. These remaining factors formed the strategic hierarchical structure of potential success factors related to competitive advantage in the ecotourism industry (Figure 4). This provided the basis for development of the second phase FAHP expert questionnaire.

The second phase analysis- FAHP

In the second phase of analysis, the purpose was to screen for the key success factors. At first, the triangular fuzzy number was used to establish the fuzzy positive reciprocal matrix. This provided the basis for calculation of the fuzzy weight values and allowed verification of the matrix’s consistency based on definite values specified by the experts. The results indicate that the C.I. and C.R. values are all \(\leq 0.1\) and this meets an acceptable deviation scope as recommended by Saaty (1980). This result indicates that previous and subsequent judgments of experts at all levels are consistent. The overall consistency ratio (C.R.H) of the hierarchical framework was 0.065. Since this value is below 0.1 suggested as a threshold by Saaty (1980), the inter-levels within the hierarchical structure are appropriate and the consistency of entire hierarchy is satisfactory.

Using this base, the relevant weights of various assessed elements in their respective levels could be analyzed (that is, development of the local priority) and then global priority of various elements in the entire hierarchy was calculated. Finally, the priority values were sorted based on the global weight calculated to identify those factors that experts asserted related to the key success factors for competitive advantage in ecotourism. The results are presented in Table 3. However, key success factors represent the vital constituents of success. Therefore, in order to determine the number of key...
success factors to focus on, this study followed Daniel's (1961) proposition that most industries have three to six key success factors. Most scholars who studied key success factors have followed this approach. In this case,
Table 2. Results of analysis using Fuzzy Delphi method.

<table>
<thead>
<tr>
<th>Assessed element</th>
<th>Assessed factor</th>
<th>Most optimistic cognition triangular fuzzy number $[o_i^l, o_i^m, o_i^u]$</th>
<th>Most conservative triangular fuzzy number $[c_i^l, c_i^m, c_i^u]$</th>
<th>Single-value geometric average</th>
<th>$M^i$</th>
<th>$Z^i$</th>
<th>Expert opinion interval</th>
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Notes: ○ denotes that the interval value of expert opinions has the consensus interval when $C_u^i \leq O_{l}^i$. Experts' consensus value was calculated as follows $G^i = (C_u^i + O_m^i) / 2$. $\Delta$ denotes $C_u^i > O_{l}^i$ and $Z^i = C_u^i - O_{l}^i$ and was less than $M^i = O_{m}^i - C_u^i$, the fuzzy set was obtained from the intersection operation and then the quantified fraction with the maximum degree of membership was obtained for this fuzzy set. They were then used to calculate the expert consensus values. Those in grey were removed during the analysis.

In terms of development of a competitive ecotourism industry, specific development strategies

Development strategies for ecotourism industry

this study chose the top six factors. These are given as follows (with the weighted values given in brackets): “attraction of resources (human and landscape)” (0.085), “volume of activities and trips” (0.074), “diversity of resources (human and environmental)” (0.072), “experience degree of resources (human and landscape)” (0.071), “overall environmental image and reputation” (0.071) and “participation of residents” (0.067).
strategies are now proposed. The concepts in this section draw both from relevant literature and the key success factors identified in this study.

Effectively addressing the issue of “attraction of resources (human and landscape)”. This could be achieved through integrating regional features and with the tourist profile. This approach is particularly related to the key success factor of attraction of resources (human and landscape). In order to respond to competition, local resources could be enhanced through alliances. For examples, holiday homes in the forest, targeted at the Taiwanese tourists, could be achieved through alliances between intra and inter industry. Also, existing resources can be reviewed, potential market segments identified and understood and then improvement work carried out accordingly. An example, in this case, is of the Dongshi Woodland. The forest resource, food and beverage provision, accommodation and entertainment facilitates were all improved in response to tourists' needs and satisfaction.

Responding to the critical factor of “volume of activities and trips”. The proposals of this study centre on providing activities reflecting seasonal changes and expectations for special activities. In terms of the former, Taiwan experiences four distinct seasons (spring, summer, autumn, winter). This provides the opportunity in different seasons to offer alternatives (e.g., trips for cherry blossoms in spring or maples in fall) to meet tourists' interests. In terms of the latter, tourists have a diversity of expectations from access to nature, exposure to different and traditional cultures to remembering bygone eras. Responses to these multiple expectations could be
Table 3. Weight analysis of key success factors in ecotourism industry.

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C.H.R=0.065
achieved through the design of trips combining multiple forms of activities.

Responding to the need for “diverse resources (human and environmental)”, Previous research has found that tourists take diversity of human and landscape resources into consideration in making their choice of trip destination (Chen and Lin, 2003). Different Recreation Opportunity Spectra (ROS) could be used to classify areas into different intensity levels. This then provides the opportunity to reduce the pressure of recreational activities on diversity of the original ecology (Peng and Mao, 2004).

In terms of “experience degree of resources (humane and landscape)”, this study would suggest strategies oriented towards the integration of natural and human features to create an appealing environment. The objective is to provide tourists with opportunities of learning and positive experiences in the environment for learning so that positive impressions drive their willingness to pay a return visit (Peng and Mao, 2004).

To respond to the needs of “overall environmental image and reputation”. An emphasis could be placed on promotional marketing activities and the use of appropriate tour guide services. Since the public often distrust unfamiliar places, they make their destination choices based on the overall environmental image and reputation. Kotler has suggested that marketing activities consist of three components: internal, external and interactive marketing. In this case a focus on the latter two seems particularly pertinent. Traditional (external) promotional activities, such as advertisement and online information could be employed. Also, to interactively market the tourist sites tour guides should effectively introduce the ecology of the environment (Chen and Lin, 2003). This effective provision of this type of service should also positively influence tourists’ attitudes and behavior local residents, culture and the natural environment. As a consequence, the overall environment image and reputation of this type of tourist destination will be enhanced.

The final critical success factor was the “participation of residents” and to achieve this suggest the employment of local work force and establishment of a benefit return mechanism. Local residents participation in and recognition of ecotourism would be greatly enhanced if they are trained as tour guide or integrated as managers. Education, too, can be used to help local people appreciate their role in the development of ecotourism and encourage their spontaneous involvement while planning the use of local resources (Peng and Mao, 2004).

CONCLUSION AND RECOMMENDATION

As landscape conservation areas are mushrooming across Taiwan and ecotourism spots are gradually increasing, it is important to consider how to operate and manage this industry. An important issue is to ensure sustainable development of ecotourism whilst not damaging the ecological resources. The study shows that critical to ecotourism is the influence of operational factors. By virtue of Porter (1985)’s value chain and the results of the literature review, a summary was created of the possible key success factors in the ecotourism industry. This provided the basis for development of a primary hierarchical structure. Based on this hierarchical structure, the Fuzzy Delphi Method and Fuzzy Hierarchical Analysis were used to extract key success factors. This study then followed the approach of other researchers to narrow this to the following six key success factors. These represent distributed primary activities. Therefore, when compared with support activities, primary activities in the value chain appear to have a more crucial influence in the development of the ecotourism industry. Moreover, with the aim of increasing the competitive advantage of the ecotourism industry, a number of development strategies were proposed related to the key success factors.

In the light of the findings, the following recommendations regarding the future development of the ecotourism industry in Taiwan are made as reference for the government, industry and other researchers.

**Government and operators**

The six key success factors that emerged from our data had been given considerable weight by our experts in comparison to other assessed items. Therefore the government has an opportunity to learn from international experience and direct key resources towards these key success factors in order to increase the possibility of achieving sustainable development in the ecotourism industry.

**Set the short/medium/long-term target for sustainable development**

Detailed specifications should be developed for the overall configuration of scenic spots and competent departments involved. In view of the fact that the ecotourism industry is still in its infancy and the government does not have an independent administrative body yet then some areas have lacked sufficient development funds. Executive departments should be given specific time targets within which to plan the ecotourism spots and build relevant maintenance and management facilities. The primary objective should be on sustainable development whilst using research to inform plans and review activities to ensure that resources not damaged or maintenance facilities are inadequate.
LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

This study is subject to a number of limitations that are now given. This study focused on state-level ecotourism spots. Future researchers could include local (such as city/county-level) or unclassified scenic spots, natural reserves and conservation areas, and other scenic spots developed by other competent departments, local government or the non-government organizations to make further studies of their differences.

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