USING THE ANALYTIC NETWORK PROCESS (ANP) IN A SWOT ANALYSIS FOR THE DEVELOPMENT OF TOURISM DESTINATION; CASE STUDY: KISH ISLAND

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ABSTRACT

SWOT analysis has been widely used to evaluate alternative strategies in order to determine the best one for given business setting; but it does not provide an analytical means to determine the importance of the identified factors or the ability to assess decision alternatives according to these factors. Although the analysis successfully pinpoints the factors, individual factors are usually described briefly and very generally. For this reason, the analytic hierarchy process (AHP) technique is utilized that removes these deficiencies. The AHP method assumes that the factors presented in the hierarchical structure are independent; however, this assumption may be inappropriate in light of certain internal and external environmental effects. Therefore, it is necessary to employ a form of SWOT analysis that measures and takes into account the possible dependency among the factors.

This paper demonstrates a process for quantitative SWOT analysis that can be performed even when there is dependence among strategic factors. The proposed algorithm uses the analytic network process (ANP), which allows measurement of the dependency among the strategic factors, as well as AHP, which is based on the independence between the factors. Dependency among the SWOT factors is observed to effect the strategic and sub-factor weights, as well as to change the strategy priorities. A tourism destination SWOT-ANP analysis is used to assess the development of tourism industry in the Kish Island. This analysis was conducted with a focus group of tourism policy and planning experts. The ANP method is preferred in this study because of its capability to model potential dependencies among the SWOT factors and the proposed SWOT-ANP methodology is implemented and tested for the Kish tourism industry. The results showed that the SWOT-ANP is a viable and highly capable methodology that provides invaluable insights for strategic management decisions in the Iran tourism industry, and can also be used as an effective tool for other complex decision making processes.
Keywords: ANP, SWOT, Development, Tourism Destination, AHP.

1. INTRODUCTION

Strategy can be explored from a variety of different perspectives and there are many definitions of what strategy is. It is important to understand these different strategic perspectives so as to gain a holistic understanding of strategy formulation and implementation. Strategy has been defined as “the direction and scope of an organization over the long term: ideally, which matches its resources to its changing environment and in particular, its markets, customers or clients to meet stakeholder expectations”. The effective management of crises and disasters is vital for the tourism industry, which is often impacted negatively by external political, economic, social and technological factors often beyond the industry’s immediate control. Strategic management is perceived as the accumulation of decisions and actions taken by business management, in consultation with all levels within the organization, to determine the long-term activities of the organization [1].

Many approaches are used to analyze strategic cases in the strategic management process. Among them, strengths, weaknesses, opportunities and threats (SWOT) analysis, which assesses the opportunities, threats, strengths and weaknesses of an organization, is the most common. SWOT analysis is a significant support tool for decision-making, and is commonly used as a means to systematically analyze an organization’s internal and external environments. By identifying its strengths, weaknesses, opportunities, and threats, the organization can build strategies upon its strengths, remove its weaknesses, and use its opportunities to counter the threats. The strengths and weaknesses are identified by an internal environment assessment while the opportunities and threats are identified by an external environment assessment. SWOT matrix, in theory, presents a mechanism for facilitating the linkage among company strengths and weaknesses, and threats and opportunities in the market place. It also provides a framework for identifying and formulating strategies [2].

SWOT matrix helps managers develop four types of strategies namely SO (strengths-opportunities) strategies, WO (weaknesses-opportunities) strategies, ST (strengths-threats) strategies, and WT (weaknesses-threats) strategies. SO strategies use a firm’s internal strengths to take advantage of external opportunities. WO strategies improve internal weaknesses by taking advantage of external opportunities. ST strategies use a firm’s strengths to avoid or reduce the impact of external threats. WT strategies are defensive tactics directed at reducing internal weaknesses and avoiding environmental threats [3]. However, SWOT analysis is not without weaknesses in the measurement and evaluation steps. In conventional SWOT analysis, the importance of the factors is not quantified to determine the effect of each factor on the proposed plan or strategy. While it does pinpoint the factors in the analysis, individual factors are usually described briefly and very generally. More specifically, SWOT allows analysts to categorize factors as being internal or external in relation to a given decision, and thus enables them to compare opportunities and threats with strengths and weaknesses. For this reason, SWOT analysis cannot comprehensively appraise the strategic decision-making process [4].

One methodology which is increasingly utilized in tourism planning and policy making is SWOT-AHP (Strengths, Weaknesses, Opportunities and Threats–Analytic Hierarchy Process) analysis. Kurtilla et al. [5] first developed SWOT-AHP and successfully used this methodology to assess whether a Finnish farm should adopt certified forestry practices. Despite the success and utility of SWOT-AHP, it has an important limitation in its assumptions. AHP assumes that each factor within its hierarchical framework operates independently from one another. For complex decisions and issues, such as tourism destination development, a methodology that incorporates interdependencies among factors might be more useful. The Analytic Network Process (ANP) provides a means by which the interdependencies among factors can be accounted for in assessing
their relative importance. It therefore seems appropriate to integrate ANP with the SWOT framework in a similar manner that AHP was applied to SWOT. Combining SWOT with ANP has been conducted in only a very small number of studies. Azimi et al. [6] used SWOT-ANP to analyze potential strategies for mining in Iran.

In this study we employ the SWOT-ANP technique to assess the current touristic situation of a tourism destination and to develop it appropriately. The emphasis of this paper is on controlling and managing complex incidents by public and private sector managers in the tourism industry, rather than other management or planning functions such as increasing market share, profitability, etc. However we look specifically at Kish Island which has well-established tourist attractions and facilities and also explore how the relative importance of identified SWOT factors is dependent on each other.

2. LITERATURE REVIEW

SWOT analysis was popularized by Andrews [7] who combined the ideas of Peter Drucker, Philip Selznick and Alfred Chandler. Drucker [8] searched for the source of the company’s success. He found out that successful organizations should have external purposes and objectives that were directed to determining customer needs and satisfying them. In light of these views, Andrews formulated SWOT analysis which proposed that a firm could generate its strategy after cautiously evaluating the components of its internal and external environments. This allowed companies to use long range planning approach based on qualitative analysis rather than quantitative forecast [9].

Over the years, ANP, a comprehensive multi-purpose decision method, has been widely used in solving many complicated decision-making problems. In two studies by Meade and Sarkis, ANP was used in a methodology they developed to evaluate logistic strategies and to improve production speed. Also, in two separate studies performed by Lee and Kim, ANP is used in the interdependent information system project selection process. Karsak et al. and Partovi and Corredoira used ANP in a quality function deployment process [10].

3. ANP METHODOLOGY

The Analytic Network Process (ANP) introduced by Saaty, is a multi-criteria approach that generalizes the AHP without making assumptions about the independence of higher level elements from lower level elements in a hierarchy or about the independence of elements in the same level (as required in the AHP). Indeed, while the AHP decomposes a problem into several levels in the form of a hierarchy of independent elements, the ANP replaces hierarchies with networks and makes it possible to structure a decision in the most general way conceivable and allows for complex interrelationships among decision levels and attributes. The ANP feedback approach replaces hierarchies with networks in which the relationships between levels are not easily represented as higher or lower, dominant or subordinate, direct or indirect [11]. The structural difference between a hierarchy and a network is illustrated in Fig1.

![Figure 1: The structural difference between a hierarchy and a network](image-url)
4. PROPOSED ANP ALGORITHM FOR SWOT

The hierarchy and network model proposed in this study for SWOT analysis is composed of four levels, as shown in Fig. 2. The goal (best strategy) is indicated in the first level, the criteria (SWOT factors) and sub criteria (SWOT sub-factors) are found in the second and third levels respectively, and the last level is composed of the alternatives (alternative strategies) [12]. A hierarchical representation of the SWOT model is given in Fig. 2a and its general network representation is presented in Fig. 2b. Here, SWOT factors, SWOT sub-factors and strategies are used in place of criteria, sub-criteria and alternatives, respectively, and the SWOT factors have inner dependencies. The main steps of our proposed framework can be summarized as follows. The letters in parentheses in Fig. 2b represent the relationship that will be signified by sub-matrices for supermatrix evaluation of the relative importance weights.

![Figure 2: (a) The hierarchical representation of the SWOT model
(b) The network representation of the SWOT model](image)

W21 is a vector which represents the impact of the goal on the criteria, W32 is a matrix that represents the impact of the criteria on each of the sub-criteria, and W43 is a matrix that represents the impact of the sub-criteria on each of the alternatives. W1 is a vector that represents the impact of the goal, namely, selecting the best strategy according to SWOT factors, W2 is a matrix that represents the inner dependence of the SWOT factors, W3 is a matrix that denotes the impact of the SWOT factor on each of the SWOT sub-factors, and W4 is a matrix that denotes the impact of the SWOT sub-factors on each of the alternatives.
To apply the ANP to matrix operations in order to determine the overall priorities of the alternative strategies identified with SWOT analysis, the proposed algorithm is as follows:

**Step 1:** Identify SWOT sub-factors and determine the alternative strategies according to SWOT sub-factors;

**Step 2:** Assume that there is no dependence among the SWOT factors; determine the importance degrees of the SWOT factors with a 1–9 scale (i.e. calculate $w_1$);

**Step 3:** Determine, with a 1–9 scale, the inner dependence matrix of each SWOT factor with respect to the other factors by using the schematic representation of inner dependence among the SWOT factors: (i.e. calculate $w_2$);

**Step 4:** Determine the interdependent priorities of the SWOT factors (i.e. calculate $w_{factors} = w_2 \times w_1$);

**Step 5:** Determine the local importance degrees of the SWOT sub-factors with a 1–9 scale (i.e. calculate $w_{sub-factors(local)}$);

**Step 6:** Determine the global importance degrees of the SWOT sub-factors (i.e. calculate $w_{sub-factors(global)} = w_{factors} \times w_{sub-factors(local)}$);

**Step 7:** Determine the importance degrees of the alternative strategies with respect to each SWOT sub-factor with a 1–9 scale (i.e. calculate $w_4$);

**Step 8:** Determine the overall priorities of the alternative strategies, reflecting the interrelationships within the SWOT factors (i.e. calculate $w_{Alternative} = w_4 \times w_{sub-factors(global)}$).

### 5. APPLICATION OF THE PROPOSED ANP-SWOT MODEL

This section presents an illustration of the proposed approach summarized in the previous section. In the following case study, SWOT analysis utilizing the ANP is performed in a tourism destination. Kish Island is located in the Persian Gulf and situated in the 18$^{th}$ km of the Mainland and considered as a part of the Hormozgan province in the south of Iran. Kish Island, amongst the Iranian Islands of the Persian Gulf, is the most important and the most famous tourism destination. Long-term management policies in this Island are to keep it a well-established tourism destination as before.

In this study, first an external environment analysis is performed by an expert team familiar with the operation of the destination. In this way, those SWOT sub-factors which affect the success of the destination but cannot be controlled are identified. In addition, an internal analysis is performed to determine the sub-factors which affect the success of the destination but can be controlled. Using the SWOT sub-factors, the SWOT matrix and alternative strategies based on these sub-factors are developed (Table 1). It can be seen from Table 1 that the destination has four alternative strategies. The strategy identified as SO involves making good use of opportunities by using the existing strengths of the destination. The WO strategy seeks to gain benefit from the opportunities presented by the external environmental factors by taking into account the weaknesses of the destination. ST is the strategy associated with using the destination’s strengths to remove or reduce the effects of threats. The fourth and last strategy is WT, in which the destination tries to reduce the effects of its threats by taking its weaknesses into account. The aim of the ANP-SWOT
analysis is to determine the priorities of the strategies developed and to determine the best strategy for the destination.

<table>
<thead>
<tr>
<th>External factors</th>
<th>Internal factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strengths (S)</strong></td>
<td><strong>Weaknesses (W)</strong></td>
</tr>
<tr>
<td>Kish international airport as an effective factor in tourism development(S1)</td>
<td>Depreciation of tourism installation(W1)</td>
</tr>
<tr>
<td>Coral cliffs attraction for tourists(S2)</td>
<td>Insufficient environmental and basic (road, sewerage, etc.)(W2)</td>
</tr>
<tr>
<td>Desirable price of services for international (foreign) tourists(S3)</td>
<td>Unsuitable distribution of tourists in different times of year(W3)</td>
</tr>
<tr>
<td>Affluence of native people and inexpensive manpower in comparison with adjacent regions(S4)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities (O)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in cooperation with Middle East in tourism industry and business opportunities(O1)</td>
</tr>
<tr>
<td>Rapid and inexpensive connection through new port to mainland(O2)</td>
</tr>
<tr>
<td>Presentation of cultural identity through tourism(O3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Threats (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massive investment of The Persian Gulf countries and capture the tourism markets by them(T1)</td>
</tr>
<tr>
<td>Ruining the traditional and native culture (language, traditions, architecture, etc.)(T2)</td>
</tr>
<tr>
<td>Extensive recreational services and facilities in other regions(T3)</td>
</tr>
<tr>
<td>Opportunity cost because of perusing one and losing the other’s benefits(T4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SO Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absorbing the private sector’s cooperation and guiding their investments into the Islands’ tourism industry</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WO Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linkaging the Island to the mainland through building the Persian Gulf Bridge</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ST Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilizing the aerial transportation opportunities in regional and international tourism business</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WT Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving the indicators of different sectors of the tourism industry to the National Average</td>
</tr>
</tbody>
</table>
Step 1: The problem is converted into a hierarchical structure in order to be measured by the ANP technique. The schematic structure established is shown in Fig. 3. The aim of "choosing the best strategy" is placed in the first level of the ANP model, the SWOT factors are in the second level, the SWOT sub-factors in the third level and four alternative strategies are placed in the last level of the model.

Step 2: Assuming that there is no dependence among the SWOT factors, pairwise comparison of the SWOT factors using a 1–9 scale is made with respect to the goal.

\[
\mathbf{w}_1 = \begin{bmatrix} \text{S} \\ \text{W} \\ \text{O} \\ \text{T} \end{bmatrix} = \begin{bmatrix} 0.482 \\ 0.232 \\ 0.193 \\ 0.093 \end{bmatrix}
\]

Figure 3: ANP model for SWOT
Step 3: Inner dependence among the SWOT factors is determined by analyzing the impact of each factor one very other factor using pairwise comparisons. The introduction section mentioned that it is notal ways possible to assume the SWOT factors to be independent. More appropriate and realistic results can likely be obtained by using both SWOT analysis and the ANP technique. Using the analysis of both the internal and external environments of the organization, the dependencies among the SWOT factors, which are presented schematically in Fig. 4, are determined. Using the computed relative importance weights, the inner dependence matrix of the SWOT factors (W2) is formed. As opportunities are affected only by the Strengths, no pairwise comparison matrix is formed for opportunities.

\[
W_2 = \begin{bmatrix}
1.0000 & 0.9001 & 0.0000 & 0.857 \\
0.0681 & 0.0000 & 0.0000 & 0.143 \\
0.6810 & 0.0001 & 0.0000 & 0.000 \\
0.2491 & 0.0000 & 0.0001 & 0.000
\end{bmatrix}
\]

Figure 4: Inner dependence among SWOT factors

Step 4: In this step, the interdependent priorities of the SWOT factors are calculated as follows:

\[
W_{FACTOR} = W_2 \ast W_1 = \begin{bmatrix}
1.0000 & 0.9001 & 0.0000 & 0.857 \\
0.0681 & 0.0000 & 0.0000 & 0.143 \\
0.6810 & 0.0001 & 0.0000 & 0.000 \\
0.2491 & 0.0000 & 0.0001 & 0.000
\end{bmatrix} \ast \begin{bmatrix}
0.482 \\
0.232 \\
0.193 \\
0.093
\end{bmatrix} = \begin{bmatrix}
0.963 \\
0.278 \\
0.521 \\
0.445
\end{bmatrix}
\]

Step 5: In this step, local priorities of the SWOT sub-factors are calculated using the pairwise comparison matrix. Priority vectors obtained by analyzing the pairwise comparison matrices are shown below.

Step 6: In this step, the overall priorities of the SWOT sub-factors are calculated by multiplying the interdependent priorities of SWOT factors found in Step 4 with the local priorities of SWOT sub-factors obtained in Step 5. The computations are provided in Table 2. The \( w_{sub-factors(global)} \) vector, obtained by using the overall priority values of the sub-factors in the last column of Table 2, is provided below.
### Table 2: Overall priority of the SWOT sub-factors

<table>
<thead>
<tr>
<th>SWOT Factors</th>
<th>Priority of the factors</th>
<th>SWOT sub-factors</th>
<th>Priority of the factors</th>
<th>Overall priority of the sub-factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength</td>
<td>0.963</td>
<td>Kish international airport as an effective factor in tourism development(S1)</td>
<td>0.396</td>
<td>0.381</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coral cliffs attraction for tourists(S2)</td>
<td>0.352</td>
<td>0.338</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Desirable price of services for international (foreign) tourists(S3)</td>
<td>0.091</td>
<td>0.087</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Affluence of native people and inexpensive manpower in comparison with adjacent regions(S4)</td>
<td>0.162</td>
<td>0.156</td>
</tr>
<tr>
<td>Weaknesses</td>
<td>0.278</td>
<td>Depreciation of tourism installation(W1)</td>
<td>0.582</td>
<td>0.161</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insufficient environmental and basic (road, sewerage, etc.)(W2)</td>
<td>0.309</td>
<td>0.085</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unsuitable distribution of tourists in different times of year(W3)</td>
<td>0.109</td>
<td>0.030</td>
</tr>
<tr>
<td>Opportunities</td>
<td>0.521</td>
<td>Increase in cooperation with Middle East in tourism industry and business opportunities(O1)</td>
<td>0.207</td>
<td>0.107</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rapid and inexpensive connection through new port to mainland(O2)</td>
<td>0.058</td>
<td>0.030</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Presentation of cultural identity through tourism(O3)</td>
<td>0.735</td>
<td>0.382</td>
</tr>
<tr>
<td>Threats</td>
<td>0.445</td>
<td>Massive investment of The Persian Gulf countries and capture the tourism markets by them(T1)</td>
<td>0.260</td>
<td>0.115</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ruining the traditional and native culture (language, traditions, architecture, etc.)(T2)</td>
<td>0.132</td>
<td>0.058</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extensive recreational services and facilities in other regions(T3)</td>
<td>0.524</td>
<td>0.233</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Opportunity cost because of perusing one and losing the other’s benefits(T4)</td>
<td>0.084</td>
<td>0.037</td>
</tr>
</tbody>
</table>

\[ w_{\text{sub-factors(glocal)}} = [0.381 \ 0.338 \ 0.087 \ 0.156 \ 0.161 \ 0.085 \ 0.030 \ 0.107 \ 0.030 \ 0.032 \ 0.115 \ 0.058 \ 0.233 \ 0.037] \]

**Step 7:** In this step we calculate the importance degrees of the alternative strategies with respect to each SWOT sub-factors. Using Expert Choice software, the eigenvectors are computed by analyzing these matrices and the matrix:

\[ w_4 = \begin{bmatrix} 0.562 & 0.5870 & 0.999 & 0.5870 & 0.232 & 0.0760 & 0.0770 & 1.000 & 1.020 & 1.5900 & 0.332 & 0.558 & 0.087 & 0.544 \\ 0.227 & 0.1220 & 0.576 & 0.139 & 0.1010 & 0.1600 & 0.1950 & 0.6790 & 0.5780 & 0.5280 & 0.500 & 0.164 & 0.315 & 0.148 \\ 0.127 & 0.2180 & 0.052 & 0.2060 & 0.4930 & 0.4240 & 0.5720 & 0.1480 & 0.2400 & 0.2490 & 0.111 & 0.219 & 0.544 & 0.259 \\ 0.0810 & 0.0720 & 0.2710 & 0.0670 & 0.0810 & 0.3920 & 1.7300 & 0.0710 & 0.0780 & 0.0610 & 0.056 & 0.057 & 0.052 & 0.046 \end{bmatrix} \]
Step 8: Finally, the overall priorities of the alternative strategies, reflecting the interrelationships within the SWOT factors, are calculated as follows:

\[
W_{\text{alternative}} = \begin{bmatrix}
    SO \\
    WO \\
    WT \\
    ST
\end{bmatrix} = \begin{bmatrix}
    0.744 \\
    0.668 \\
    0.571 \\
    0.314
\end{bmatrix}
\]

The ANP analysis results indicate that SO is the best strategy with an overall priority value of 0.744.

6. COMPARING THE AHP AND ANP RESULTS

According to the ANP analysis, alternative strategies are ordered as SO–WO–WT–ST. The same example is analyzed with the hierarchical model by assuming there is no dependence among the factors. The overall priorities computed for the alternative strategies are presented below. The same pairwise comparison matrices are used to compute the AHP priority values.

\[
W_{\text{alternative}} = \begin{bmatrix}
    0.356 \\
    0.240 \\
    0.308 \\
    0.094
\end{bmatrix}
\]

In the AHP analysis, the SO strategy is found to be the best alternative, with an overall priority value of 0.356. However, the priority ordering of the alternative strategies is changed to SO–WT–WO–ST. When dependence among factors is taken into account, both the strategy priorities and the ranking order of the strategies changes. AHP analysis can be used in situations where there is no dependency among SWOT factors and sub factors or where the level of this dependency can be neglected.

CONCLUSION

In SWOT analysis, strategic alternatives are selected in the light of the strengths, weaknesses, threats and opportunities of the organization as determined through internal and external environment analysis. However, SWOT analysis is not capable of quantitatively determining the weights and effects of the strategic factors on the alternatives. Although some studies do perform such quantitative weighting, these studies fail to consider the relations or dependencies of the factors of the SWOT analysis. It is generally not possible to assume the SWOT factors to be independent and unrelated with one another.

In this study, we sought to demonstrate, with a case study example, that it is possible to perform a quantitative SWOT analysis wherein the possible dependencies among SWOT factors are included. The ANP technique, which enables measuring inter-factor dependencies, is utilized in this work. ANP is a technique that is used in solving multiple-criteria decision-making problems where there is dependency between factors that are both qualitative and quantitative in nature. Moreover, problems that are modeled by the ANP pairwise comparison matrices used to determine the priority values for the factors are determined by the judgment of experts. Finally, we can conclude that organizations involved in the Kish Islands’ tourism development should focus on absorbing the private sector’s cooperation and guiding their investments into the Islands’ tourism industry and linkaging the Island to the mainland through building the Persian Gulf Bridge.
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