Comparing AHP and ANP: An Application of Strategic Decisions Making in a Manufacturing Company

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Abstract

Successful strategic decisions provide the appropriate operational actions for the right markets at the correct time. Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis is a generally used tool which examines strengths and weaknesses of organization or industry together with opportunities and threats of the marketplace environment. SWOT framework provides the basic outline in which to perform analysis of decision situations. In this study, the lack of determination of the importance ranking for the SWOT factors, we proposed to enhance SWOT analysis with multicriteria decision making techniques called Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP). AHP approach achieves pairwise comparisons among factors or criteria in order to prioritize them at each level of the hierarchy using the eigenvalue calculation. In addition to AHP, ANP technique is a general form that allows interdependencies, outerdependencies and feedbacks among decision elements in the hierarchical or non hierarchical structures. The main purpose of this paper is to explain how to use the AHP and ANP methods for prioritize of SWOT factors and compare them.

Keywords: AHP, ANP, Strategic Decisions, SWOT.

1. Introduction

Business organizations today deal with unprecedented challenges, opportunities and threats in carrying out their mission. Managers always look for comprehensive picture of present condition of the organization and analyze of its future situation considering internal and external environment (Azimi et al., 2011). The description of internal strengths and weaknesses, as well as external opportunities and threats, takes place on the basis of a well-known technique called SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis (Houben et al., 2009). SWOT analysis is a generally applying method for analyzing both environments in order to attain a systematic approach and support for a decisions. Moreover, SWOT includes no means of analytically determining the importance of the factors or of assessing the decision alternatives with respect to the factors (Kangas et al., 2003).

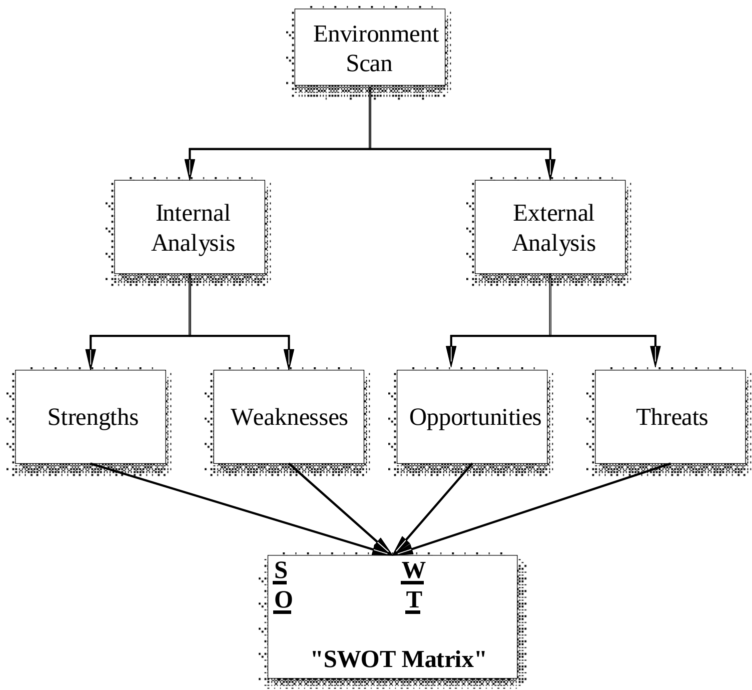
In this paper, a quantitative based SWOT analysis has been proposed to determine priorities among SWOT factors systematically. The proposed method is obtained by performing Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP).

2. SWOT, AHP and ANP

2.1 SWOT Analysis

The internal and external factors most considerable for the company's future are referred to as strategic factors. In SWOT analysis, these factors are grouped into four parts called SWOT groups: strengths, weaknesses, opportunities, and threats. By applying SWOT in strategic decisions, the purpose is to select or constitute and implement a strategy resulting in a good fit between the internal and external factors (Kangas et al., 2003). Moreover, the chosen strategy has also to be in line with the current and future purposes of the decision makers (Pesonen et al., 2003). SWOT involves systematic thinking and comprehensive diagnosis of factors relating to a new product, technology, management, or planning. SWOT matrix is a commonly used tool for analyzing external and internal environments concurrently in order to support for a decision situation (Kurtilla et al., 2000; Kangas et al., 2003; Yüksel and Dağdeviren, 2007). Figure 1 shows how SWOT analysis fits into an environment scan (Kahraman et al., 2008).

Figure 1: SWOT analysis framework [29]



2.2 Analytic Hierarchy Process

AHP is a multicriteria decision making technique that can help express the general decision operation by decomposing a complicated problem into a multilevel hierarchical structure of objective, criteria and alternatives (Sharma et al., 2008). AHP performs pairwise comparisons to derive relative importance of the variable in each level of the hierarchy and / or appraises the alternatives in the lowest level of the hierarchy in order to make the best decision among alternatives. AHP is a effective decision making method especially when subjectivity exists and it is very suitable to solve problems where the decision criteria can be organized in a hierarchical way into sub-criteria (Tuzmen and Sipahi, 2011).

AHP is used to determine relative priorities on absolute scales from both discrete and continuous paired comparisons in multilevel hierarchic structures (Saaty and Vargas, 1996). The prioritization mechanism is accomplished by assigning a number from a comparison scale (see Table 1) developed by Saaty (1980, 1996) to represent the relative importance of the criteria. Pairwise comparisons matrices of these factors provide the means for calculation of importance (Sharma et al., 2008).

Table 1: Pairwise Comparison Scale

(Saaty, 1996; Yüksel and Dağdeviren, 2007)

Intensity of importance	Explanation
1	Two criterion contribute equally to the objective
3	Experience and judgement slightly favor one over another
5	Experience and judgment strongly favor one over another
7	Criterion is strongly favored and its dominance is demonstrated in practice
9	Importance of one over another affirmed on the highest possible order
2, 4, 6, 8	Used to represent compromise between the priorities listed above

The AHP method is based on three principles: first, structure of the model; second, comparative judgment of the criteria and/or alternatives; third, synthesis of the priorities. In the literature; AHP, has been widely used in solving many decision making problems (Kurttila et al., 2000; Kangas et al., 2001, Pesonen et al., 2001; Kajanusa et al., 2004; Arslan and Turan, 2009; Kandakoğlu et al., 2009; Dinçer and Görener, 2011; Lee and Walsh, 2011).

In the first step, a decision problem is structured as a hierarchy (Dağdeviren et al., 2009). AHP initially breaks down a complex multicriteria decision making problem into a hierarchy of interrelated decision elements (criteria, decision alternatives). With the AHP, the objectives, decision criteria and alternatives are arranged in a hierarchical structure similar to a family tree (Albayrak and Erensal, 2004).

The second step is the comparison of the criteria and/or the alternatives. Once the problem has been decomposed and the hierarchy is constructed, prioritization procedure starts in order to determine the relative importance of the criteria. In each level, the criteria are compared pairwise according to their levels of influence and based on the specified criteria in the higher level. In AHP, multiple pairwise comparisons are based on a standardized comparison scale of nine levels (Albayrak and Erensal, 2004).

Let $C = \{C_j \mid j = 1, 2, \ldots, n\}$ be the set of criteria. The result of the pairwise comparison on n criteria can be summarized in an (n x n) evaluation matrix A in which every element a_{ij} ($i, j = 1, 2, \ldots, n$) is the quotient of weights of the criteria. This pairwise comparison can be shown by a square and reciprocal matrix, (see Eq. (1)).

$$A = \left(a_{ij}\right)_{nxn} = \begin{bmatrix} a_{11} & a_{12} & \ldots & a_{1n} \\ a_{21} & a_{22} & \ldots & a_{2n} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ a_{n1} & a_{n2} & . & a_{nn} \end{bmatrix} \quad (1)$$

At the last step, each matrix is normalized and be found the relative weights. The relative weights are given by the right eigenvector (w) corresponding to the largest eigenvalue (λ_{max}), as:

$$A_w = \lambda_{max}.w \quad (2)$$

If the pairwise comparisons are completely consistent, the matrix A has rank 1 and $\lambda_{max} = n$. In this case, weights can be obtained by normalizing any of the rows or columns of A (Albayrak and Erensal, 2004; Wang and Yang, 2007; Boraji and Yakchali, 2011). It should be noted that the quality of the output of the AHP is related to the consistency of the pairwise comparison judgments. The consistency is defined by the relation between the entries of A: a_{ij} x $a_{jk} = a_{ik}$ (Dağdeviren et al., 2009). The Consistency Index (CI) can be calculated, using the following formula (Saaty, 1980):

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (3)$$

Using the final consistency ratio (CR) can conclude whether the evaluations are sufficiently consistent. The CR is calculated as the ratio of the CI and the random index (RI), as indicated in Eq. (4). The number 0.1 is the accepted upper limit for CR. If the final consistency ratio exceeds this value, the evaluation procedure has to be repeated to improve consistency (Boraji and Yakchali, 2011)

$$CR = \frac{CI}{RI} \quad (4)$$

Table 2: Random Index (Saaty and Vargas, 1991)

n	1	2	3	4	5	6	7	8	9	10
RI	0,00	0,00	0,58	0,90	1,12	1,24	1,32	1,41	1,45	1,49

2.3 Analytic Network Process

AHP and ANP are essentially ways to measure especially intangible factors by using pairwise comparisons with judgments that represent the dominance of one element over another with respect to a property that they share (Chung et al., 2005). The Analytic Network Process is a generalization of the Analytic Hierarchy Process.

Many decisions problems cannot be structured hierarchically because they involve the interaction and dependence of higher level elements in a hierarchy on lower level elements (Saaty and Özdemir, 2005). While the AHP represents a framework with a uni-directional hierarchical AHP relationship, the ANP allows for complex interrelationships among decision levels and attributes (Yüksel and Dağdeviren, 2007).

ANP approach comprises four steps (Satty, 1996; Chung et al., 2005; Yüksel and Dağdeviren, 2007):

Step 1: Model construction and problem structuring: The problem should be stated clearly and decomposed into a rational system like a network

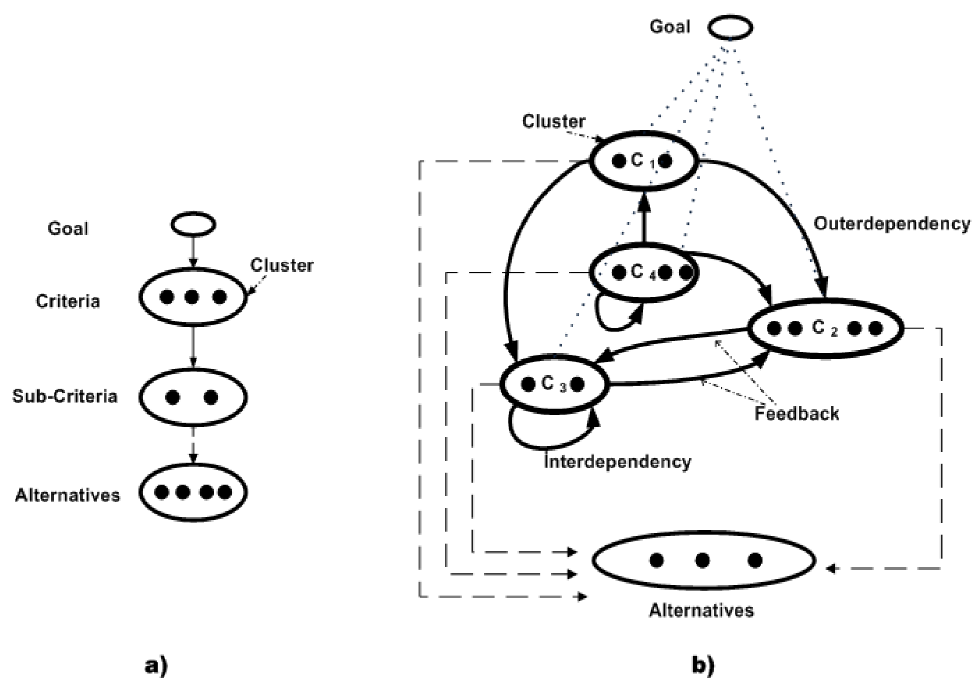
Step 2: Pairwise comparisons and priority vectors: In ANP, like AHP, pairs of decision elements at each cluster are compared with respect to their importance towards their control criteria. In addition, interdependencies among criteria of a cluster must also be examined pairwise; the influence of each element on other elements can be represented by an eigenvector. The relative importance values are determined with Saaty's scale.

Step 3: Supermatrix formation: The supermatrix concept is similar to the Markov chain process. To obtain global priorities in a system with interdependent influences, the local priority vectors are entered in the appropriate columns of a matrix. As a result, a supermatrix is actually a partitioned matrix, where each matrix segment represents a relationship between two clusters in a system.

Step 4: Synthesis of the criteria and alternatives' priorities and selection of the best alternatives: The priority weights of the criteria and alternatives can be found in the normalized supermatrix.

Although the AHP technique removes the deficiencies inherent in the measurement and evaluation steps of SWOT analysis, it does not measure the possible dependencies and feedbacks among the SWOT factors (Yüksel and Dağdeviren, 2007). The structural difference between a hierarchy and a network processes are pictured in Figure 2.

Figure 2: Structural Difference between Hierarchy (a) and Network (b) Processes



While AHP has been very popular, ANP is less prominent in the literature (Othman et al., 2011). There are some studies studies that use ANP. Chung et al. (2005) applied ANP to constitute product mix planning in semiconductor fabricator. Dağdeviren and Yüksel (2007) developed an ANP-based personnel selection system and weighted personnel selection factors. Greda (2009) used the ANP to select the most efficient option of quality management system in food industry. Yang et al. (2009) developed a manufacturing evaluation system model with ANP approach for wafer fabricating industry. Valmohammadi (2010) used the ANP to identify specific resources and capabilities of an Iranian dairy products firm and to develop an evaluation framework of business strategy. Ayağ (2011) proposed ANP-based approach to evaluate a set of simulation software alternatives.

Hsu and Kuo (2011) applied the ANP method for selecting the optimal full-service advertising agency. Agarwal and Vijayvargy (2011) presented a comprehensive method for the evaluation and selection of suppliers' offers in food industry.

2.4 SWOT- AHP / ANP Model

SWOT analysis does not provide means of systematically determining the relative importance of the criteria or to assess decision alternatives according to the these criteria. In order to handle this insufficiency, the SWOT framework is converted into a hierarchic / network structure and the model is integrated and analyzed using the AHP / ANP (Kangas et al., 2001; Kajanusa et al., 2004).

The objective in utilizing the AHP and ANP within SWOT framework is to systematically qualify SWOT factors and equate their intensities (Wickramansinghe and Takano, 2010). The proposed method is applied in three steps (Gallego-Ayala and Juizo, 2011):

Step 1: The first step is to list the considerable internal (strengths and weaknesses) and external (opportunities and threats) factors for the strategic planning, making-up the SWOT analysis.
Step 2: The second step applies the pairwise comparisons to capture the weights of each SWOT group.
Step 3: Finally the third step uses the AHP to derive the relative priorities of each factor within the SWOT groups. Then, the overall factor weight rank is obtained by multiplying the factors local weights by the specific group weight.

To apply the ANP to matrix operations in order to determine the overall priorities of SWOT factors, the proposed algorithm is as follows (Yüksel and Dağdeviren, 2007):

Step 1: Identify SWOT 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.
Step 3: Determine the dependence matrix of each SWOT factor with respect to the other factors by using the schematic representation of dependence among the SWOT factors.
Step 4: Determine the dependent priorities of the SWOT factors.
Step 5: Determine the local importance degrees of the SWOT sub-factors with a 1-9 scale.
Step 6: Determine the global importance degrees of the SWOT sub-factors.

The problem of constitute a quantitative based SWOT analysis with AHP has been investigated by several researchers. Kurttila et al. (2000) developed a integrated SWOT analysis with AHP to make factors commensurable and to support a more quantitative basis in the strategic planning (Gao and Peng, 2011). This enhanced method has been broadly applied and studied in miscellaneous areas: from the view of applications, the integrated SWOT-AHP method has been used to determine the outsourcing decisions for sport marketing (Lee and Walsh, 2011), evaluate the management strategies of a forestland estate (Kangas et al., 2003), evaluate the tourism revival strategic marketing plan for Sri Lanka (Wickramansinghe and Takano, 2010), strategic planning of natural resource management (Pesonen et al., 2001), analyze the global competitiveness of manufacturers of machine tools (Shinno et al., 2006), formulate the strategy of the safe carriage of bulk liquid chemicals in tankers (Arslan and Er, 2008), determine the business strategy in textile firm (Yüksek and Akın, 2006), establish the strategy for Turkish chemicals industry (Taşkın and Güneri, 2005), analytical investigation of marine casualties at the Strait of Istanbul (Arslan and Turan, 2009), shipping registry selection in maritime transportation industry (Kandakoğlu et al., 2009), strategic implementation of integrated water resources management in Mozambique (Gallego-Ayala and Juizo, 2011).

There are very limited studies dealing with ANP- based SWOT analysis, when compared with SWOT-AHP applications. Yüksel and Dağdeviren (2007) used SWOT analysis and ANP integrated model to select an alternative strategy for a textile firm. Wang et al. (2011) applied the ANP embedding into SWOT to analyze of the cumulative effect of pollution in the atmospheric environment management. Azimi et al. (2011) proposed an integrated model for prioritizing the strategies of Iranian mining sector. They used ANP to obtain the weight of SWOT factors. Ostrega et al. (2011) structured ANP based SWOT approach to minimize environmental impacts due mining activities. Fouladgar et al. (2011) purposed integrated model with ANP to obtain the weight of SWOT factors. Foroughi et al. (2012) developed approach to prioritize the strategies of Islamic Azad University by using SWOT analysis with ANP method.

3. Application

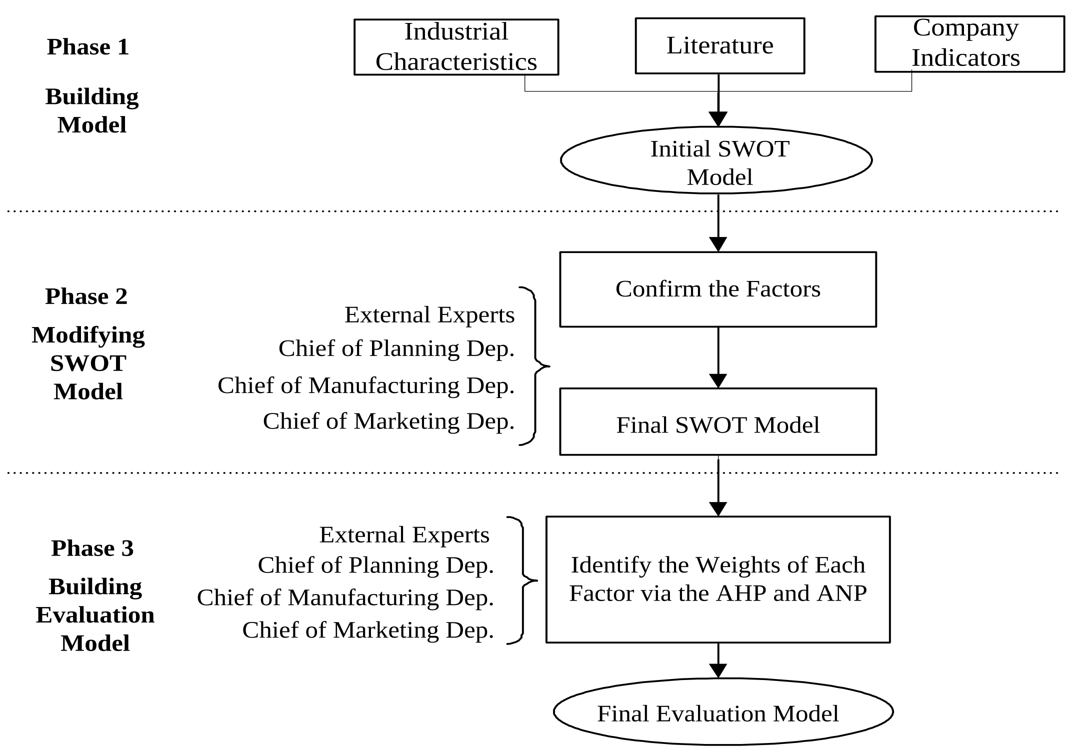
The main idea in utilizing the AHP / ANP within the SWOT frame is to systematically appraise the SWOT factors and make them commensurable as regards their weightiness (Kangas et al., 2003). In the following case study, SWOT analysis enhanced the AHP / ANP is performed on a firm which produces cooker hoods in Istanbul, Turkey. The company usually exports its products over 50 countries all around the world. Saaty's comparison scale using to carry out pairwise comparisons and determined the relative importance between each pair of SWOT factors. After the digitizing SWOT frame via AHP / ANP, with the obtained aggregated matrix it was possible to derive the vector weights or priorities for the groups and factors analysed.

To create a SWOT - AHP / ANP based model, designed the following three phases model: building initial task; modifying factors, and building an evaluation model (Figure 3).

Table 3: SWOT Matrix

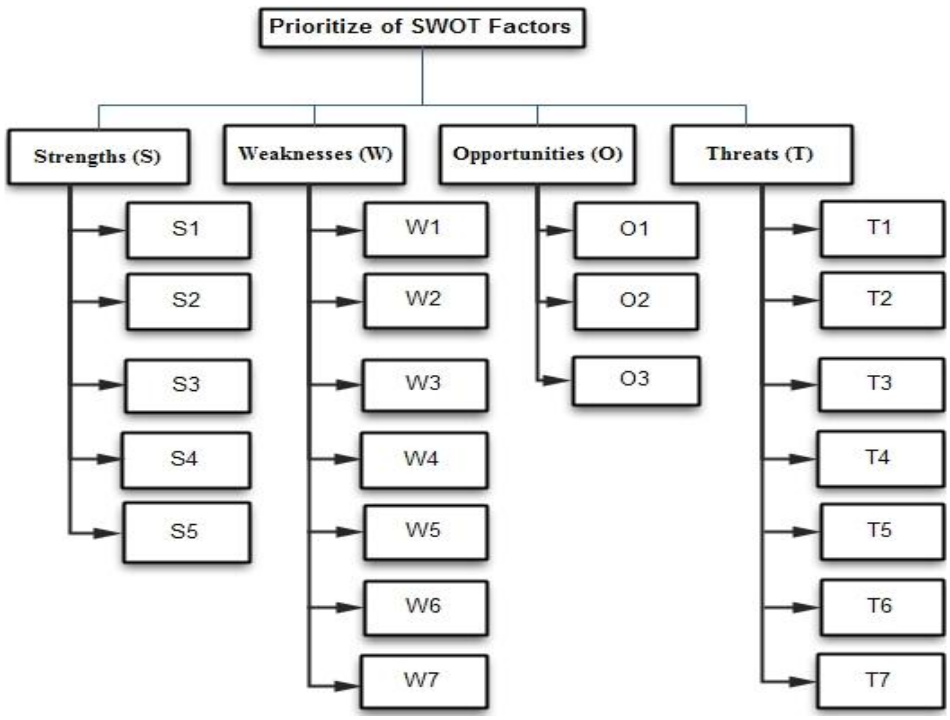
Strengths (S)	**Weaknesses (W)**
(S1) Innovative capacity **(S2)** Availability of resources and skills **(S3)** Quality of the product **(S4)** Expert management staff **(S5)** Reliability in marketplace	**(W1)** Lack of performance measurement systems **(W2)** Non flexible organizational structure **(W3)** Energy costs **(W4)** Labor costs **(W5)** Lack of accurate forecasting capability **(W6)** Logistics costs **(W7)** Lack of well-known own brands
Opportunities (O)	**Threats (T)**
(O1) Rising living standarts and increasing modern buildings **(O2)** Globalization and the decreased trade barrier **(O3)** New foreign markets	**(T1)** Macroeconomic instability. **(T2)** Competition **(T3)** Political instability and possible problems in regional geographical area, especially Middle East **(T4)** Different and changing international market mechanisms **(T5)** Strengthening environmental pressures **(T6)** Different standardization request of international customers **(T7)** Low income per unit

Figure 3: Model of Proposed Methodology (Modified from Yang et al., 2009)



Firstly, SWOT analysis is carried out and matrix is structured. The relevant factors of firm's external and internal environment are defined and built in the SWOT matrix. Four experts and management staff of the firm contributed their knowledge and experience to structure the SWOT factors. AHP is applied to SWOT matrix. Traditional hierarchical structure of AHP is appear in Figure 4.

Figure 4: Hierarchical Structure of SWOT-AHP



Secondly, pairwise comparisons of the SWOT groups, using a Saaty's (1980) comparison scale, are made. The comparison results are shown in Table 4. SWOT factors are compared considering every SWOT group. All pairwise comparisons in the application are performed by the expert group. They contributed their professional experience to constructed the comparison matrices of hierarchy process and determined dependecies to carry out pairwise comparisons with additional matrices for network process.

Table 4: Pairwise Comparisons of SWOT Factors

SWOT Groups	S	W	O	T	Importance Degrees of SWOT Groups
Strengths (S)	1.000	3.000	1.000	3.000	0.367
Weaknesses (W)	0.333	1.000	0.250	2.000	0.146
Opportunities (O)	1.000	4.000	1.000	2.000	0.365
Threats (T)	0.333	0.500	0.500	1.000	0.123
CR = 0.06					

Table 5: Comparison Matrix of Strengths Group

Strengths	S1	S2	S3	S4	S5	Importance Degrees
(S1) Innovative capacity	1.000	0.500	0.200	0.500	0.167	0.057
(S2) Availability of resources and skills	2.000	1.000	0.167	0.200	0.167	0.065
(S3) Quality of the product	5.000	6.000	1.000	3.000	2.000	0.400
(S4) Expert management staff	2.000	5.000	0.333	1.000	0.200	0.144
(S5) Reliability in marketplace	6.000	6.000	0.500	4.000	1.000	0.334
CR = 0.08						

Table 6: Comparison Matrix of Weaknesses Group

Weaknesses	W1	W2	W3	W4	W5	W6	W7	Importance Degrees
(W1)Lack of performance measurement systems	1.000	3.000	0.200	0.200	0.500	0.250	0.500	0.055
(W2)Non flexible organizational structure	0.333	1.000	0.167	0.167	0.500	0.200	0.500	0.035
(W3) Energy costs	5.000	6.000	1.000	1.000	6.000	2.000	7.000	0.294
(W4) Labor costs	5.000	6.000	1.000	1.000	6.000	2.000	7.000	0.294
(W5) Lack of accurate forecasting capability	2.000	2.000	0.167	0.167	1.000	0.200	0.500	0.056
(W6) Logistics costs	4.000	5.000	0.500	0.500	5.000	1.000	7.000	0.204
(W7) Lack of well-known own brands	2.000	2.000	0.143	0.143	2.000	0.143	1.000	0.062
CR = 0.06								

Table 7: Comparison Matrix of Opportunities Group

Opportunities	O1	O2	O3	Importance Degrees
(O1) Rising living standarts and increasing modern buildings	1.000	2.000	3.000	0.539
(O2) Globalization and the decreased trade barrier	0.500	1.000	2.000	0.297
(O3) New foreign markets	0.333	0.500	1.000	0.164
CR = 0.08				

Table 8: Comparison Matrix of Threats Group

Threats	T1	T2	T3	T4	T5	T6	T7	Importance Degrees
(T1)Macroeconomic instability	1.000	0.333	2.000	1.000	0.333	0.500	0.500	0.095
(T2)Competition	3.000	1.000	1.000	2.000	4.000	3.000	1.000	0.239
(T3)Political instability and possible problems in regional geographical area, especially Middle East	0.500	1.000	1.000	1.000	0.500	1.000	0.333	0.101
(T4)Different and changing international market mechanisms	1.000	0.500	1.000	1.000	3.000	1.000	0.500	0.124
(T5) Strengthening environmental pressures	3.000	0.250	2.000	0.333	1.000	0.250	0.250	0.098
(T6)Different standardization request of international customers	2.000	0.333	1.000	1.000	2.000	1.000	0.333	0.113
(T7) Low income per unit	2.000	1.000	3.000	2.000	2.000	3.000	1.000	0.2311
CR = 0.08								

Finally, the overall priority scores of the SWOT factors are calculated. Overall priorities are shown in Table 9. The AHP analysis results indicate that "Rising living standarts and increasing modern buildings" are the most important issues considering a cooker hoods manufacturer's internal and external environments.

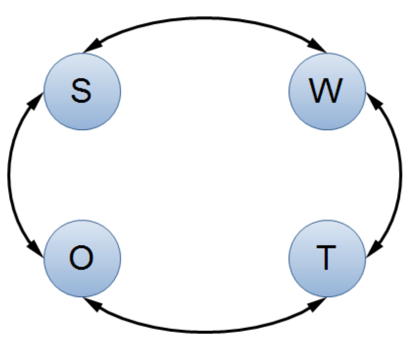
After the AHP analysis, in this section, ANP technique is used. Inner dependece among the SWOT factors is extracted by considering the impact of each factor on every other factor using comparison matrices.

As mentioned, existence of dependence among factors can be modeled through the ANP approach. The dependences among the SWOT factors are established that are shown schematically in Figure 5 (Azimi et al., 2011).

Table 9: Overall Priority Scores of SWOT Factors with AHP

Swot Group	Group Priority	Swot Factors	Factor Priority within the Group via AHP	Overall Priority of Factor
Strengths	0.367	Innovative capacity	0.057	0.021
		Availability of resources and skills	0.065	0.024
		Quality of the product	**0.400**	**0.147**
		Expert management staff	0.144	0.053
		Reliability in marketplace	0.334	0.122
Weaknesses	0.146	Lack of performance measurement systems	0.055	0.008
		Non flexible organizational structure	0.035	0.005
		Energy costs	**0.294**	**0.043**
		Labor costs	**0.294**	**0.043**
		Lack of accurate forecasting capability	0.056	0.008
		High logistics costs	0.204	0.030
		Lack of well-known own brands	0.062	0.009
Opportunities	0.365	**Rising living standards and increasing modern buildings**	**0.539**	**0.197**
		Globalization and the decreased trade barrier	0.297	0.108
		New foreign markets	0.164	0.060
Threats	0.123	Macroeconomic instability	0.095	0.012
		Competition	**0.239**	**0.029**
		Political instability and possible problems in regional geographical area, especially Middle East	0.101	0.012
		Different and changing international market mechanisms	0.124	0.015
		Strengthening environmental pressures	0.098	0.012
		Different standardization request of international customers	0.113	0.014
		Low income per unit	0.231	0.028

Figure 5: Inner Dependence Among SWOT Factors



At this point to determine ANP-based SWOT groups' priorities, pairwise comparison matrices are generated, Fig. 5 had to be taken into consideration (Table 10, 11, 12 and 13). Considering the calculated relative importance, the inner dependence matrix of SWOT factors is generated. As each factor of the SWOT is affected by two other factors, so that; S factor is affected by W and O factors, W factor is affected by S and T factors, O factor is affected by T and S factors, T factor is affected by W and O factors (Azimi et al., 2011).

Table 10: The Inner Dependence Matrix with Respect to "S"

S	W	O	Importance Degrees
W	1.000	2.600	0.722
O	0.385	1.000	0.278
CR = 0.00			

Table 11: The Inner Dependence Matrix with Respect to "W"

W	S	T	Importance Degrees
S	1.000	3.200	0.762
T	0.313	1.000	0.238
CR = 0.00			

Table 12: The Inner Dependence Matrix with Respect to "O"

O	T	S	Importance Degrees
T	1.000	3.600	0.783
S	0.278	1.000	0.217
CR = 0.00			

Table 13: The Inner Dependence Matrix with Respect to "T"

T	W	O	Importance Degrees
W	1.000	1.800	0.643
O	0.556	1.000	0.357
CR = 0.00			

Table 14: Inner Dependence Matrix of SWOT Factors

1	0.762	0.783	0
0.722	1	0	0.643
0.278	0	1	0.357
0	0.238	0.217	1

SWOT groups priorities that computed considering inner dependencies is shown as follows (Eq. (5)):

$$\begin{matrix} 1 & 0.762 & 0.783 & 0 \\ 0.722 & 1 & 0 & 0.643 \\ 0.278 & 0 & 1 & 0.357 \\ 0 & 0.238 & 0.217 & 1 \end{matrix} \quad \mathbf{x} \quad \begin{matrix} 0.367 \\ 0.146 \\ 0.365 \\ 0.123 \end{matrix} \quad = \quad \begin{matrix} 0.382 \\ 0.244 \\ 0.255 \\ 0.119 \end{matrix} \qquad (5)$$

A new situation about priorities of SWOT groups that occur considering inner dependencies have important differences, if compared SWOT groups priorities with assumption of independence. The results change from 0.367 to 0.382, 0.146 to 0.244, 0.365 to 0.255, and 0.123 to 0.119 for the priority values of factors S, W, O and T, respectively.

Dependencies and feedbacks in different factors of SWOT groups took into account using network structure. For example, some factors in Threats group can be effected “Low income per unit” factor in Weaknesses group (Table 15). Dependence among the SWOT factors is determined by analyzing the impact of each factor on every other factor using pairwise comparisons. After that, the overall priorities of the SWOT factors are calculated by multiplying the dependent priorities of SWOT groups with the local priorities of SWOT factors. More appropriate and realistic results can likely be obtained by using both SWOT analysis and the ANP technique (Yüksel and Dağdeviren, 2007).

Table 15: Example of Dependence Matrix (Threats group’s factor effected Weaknesses group’ factor)

For “Low income per unit (T7)”	W3	W4	W6	W7	Importance Degrees
(W3) Energy costs	1.000	2.000	2.000	4.000	0.348
(W4) Labor costs	0.500	1.000	2.000	5.000	0.364
(W6) Logistics costs	0.500	0.500	1.000	5.000	0.222
(W7) Lack of well-known own brands	0.250	0.200	0.200	1.000	0.066
CR = 0.03					

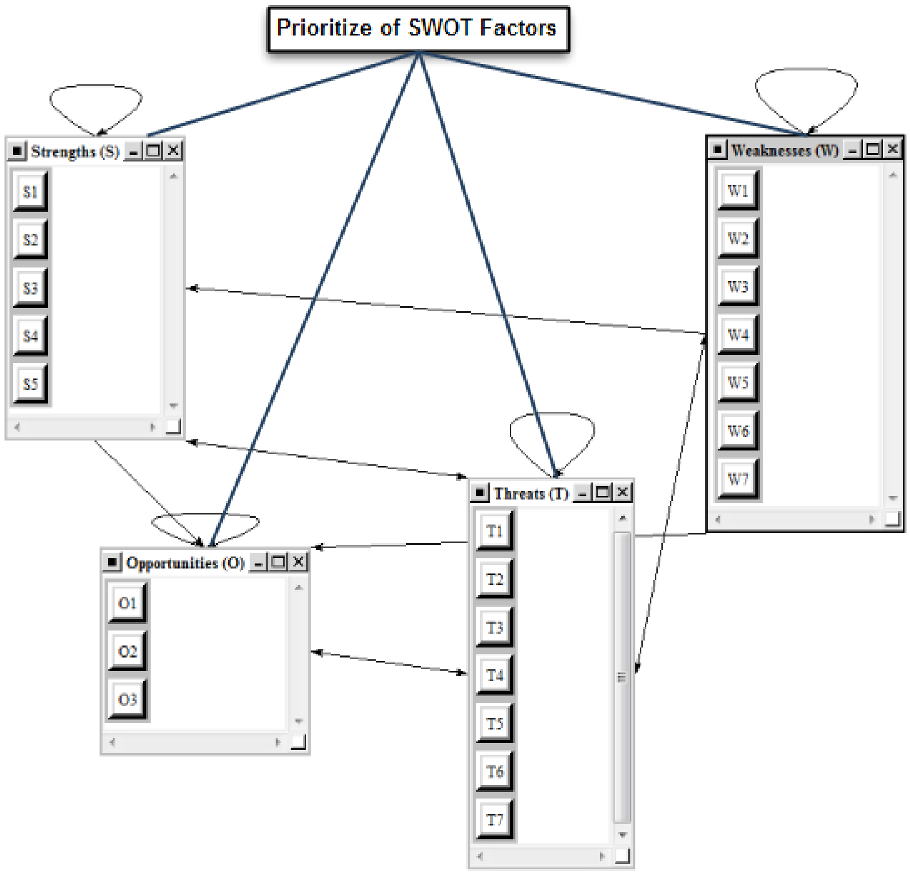
A network structure of SWOT-ANP model is shown in Figure 6. And the overall priorities of the SWOT factors calculated by the ANP are shown in Table 16. The ANP results obtained from Super Decisions software. According to the ANP-based analysis, “New foreign markets” is the most important SWOT factor.

4. Comparing the AHP and ANP Results

This section, the results from the SWOT-AHP model were compared with ANP based model. The findings show the following AHP ranking of each SWOT group priority: Strengths (group weight 36.7%), Opportunities (36.5%), Weaknesses (14.6%) and Threats (12.3%). According to the AHP based analysis, the most important factor in SWOT is “Rising living standarts and increasing modern buildings” from Opportunities group. This matter is the most important factor to be considered with an overall priority value of 0.197. Other considerable factors are ranked as follows according to priority: Quality of the product (14.7%), Energy costs (4.3%), Labor costs (4.3%) and Competition (2.9%) factors.

In the ANP-based evaluation model, ranking of each SWOT group priority: Strengths (group weight 38.2%), Opportunities (25.5%), Weaknesses (24.4%) and Threats (11.9%). SWOT factors’ priorities value obtained with ANP, the most considerable factor in analysis is “New foreign markets” from Opportunities group with 0.183 overall priority value. Important factors are ranked as follows according to priority: Quality of the product (14.2%), Expert management staff (11.6%), Availability of resources and skills (9.5%) and Labor costs (7.7%) factors. Comparison of results shows that there are significant differences between AHP and ANP outcome derived from interdependencies, outerdependencies and feedbacks.

Figure 6: Network structure of SWOT-ANP.



5. Conclusion

In this paper, we have determined significant strategic factors to cooker hoods manufacturing firm by combining SWOT with AHP and ANP decision making techniques. Using calculated priorities of SWOT factors could be developed a management approach or supported for a critical decisions. Additionally, this study's results can be used for the constitute of a set of appropriate strategy alternatives for organization. Future research could improve the using fuzzy logic framework with the AHP / ANP method to more effectively analyze cases having uncertainty.

Table 16: Overall Priority Scores of SWOT Factors with ANP

Swot Group	Group Priority with Dependencies	Swot Factors	Factor Priority within the Group via ANP	Overall Priority of Factor
Strengths	0.382	Innovative capacity	0.076	0.029
		Availability of resources and skills	0.249	0.095
		Quality of the product	**0.371**	**0.142**
		Expert management staff	0.303	0.116
		Reliability in marketplace	0.001	0.000
Weaknesses	0.244	Lack of performance measurement systems	0.041	0.010
		Non flexible organizational structure	0.010	0.002
		Energy costs	**0.308**	**0.075**
		Labor costs	**0.316**	**0.077**
		Lack of accurate forecasting capability	0.001	0.000
		High logistics costs	0.210	0.051
		Lack of well-known own brands	0.114	0.028
Opportunities	0.255	Rising living standarts and increasing modern buildings	0.003	0.001
		Globalization and the decreased trade barrier	0.278	0.071
		New foreign markets	**0.718**	**0.183**
Threats	0.119	Macroeconomic instability	0.140	0.017
		Competition	**0.255**	**0.030**
		Political instability and possible problems in regional geographical area, especially Middle East	0.189	0.022
		Different and changing international market mechanisms	0.136	0.016
		Strengthening environmental pressures	0.003	0.000
		Different standardization request of international customers	0.138	0.016
		Low income per unit	0.140	0.017

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