

Application of Combined SWOT and AHP: A Case Study for a Manufacturing Firm

Authors: Ali Gorener, Kerem Toker, Korkmaz, Ulucay

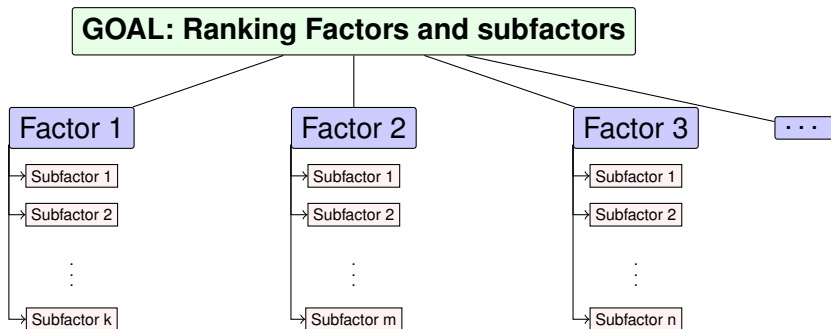
Contents

- AHP- *Analytic Hierarchy Process*
- Applying AHP in SWOT analysis (*Strengths, Weaknesses, Opportunities and Threats Analysis*)

Aim of this case study:

- Analysing SWOT subfactors of a manufacturing firm in Turkey
- Ranking the factors and subfactors

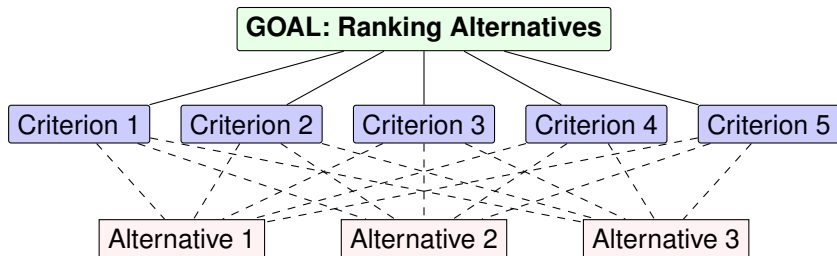
MODEL 1



- Prioritizing **factors**
- Prioritizing **subfactors** locally or globally

MODEL 2

(proposed 5 criteria and 3 alternatives)



- Prioritizing **criteria**
- Prioritizing **alternatives** based on each criterion
- Ordering the preferences of alternatives

Model 2
Table of Weights

Alternatives	Decisive Criterion					<i>Weight</i>
	C_1	C_2	C_3	C_4	C_5	
	w_1	w_2	w_3	w_4	w_5	
A_1	a_{11}	a_{12}	a_{13}	a_{14}	a_{15}	p_1
A_2	a_{21}	a_{22}	a_{23}	a_{24}	a_{25}	p_2
A_3	a_{31}	a_{32}	a_{33}	a_{34}	a_{35}	p_3

Pairwise Comparison Scale- Saaty Scale

Importance	Explanation
1	Two criteria contribute equally to the objective
3	Experience and judgment 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

Pairwise Comparison Matrix

$$A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & & & \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{pmatrix}$$

- a_{ij} : the importance of criterion A_i compared to criterion A_j in Saaty Scale
- $a_{ij} = 1/a_{ji}$ or reciprocal

Theoretical Weight Quotient Matrix of Criteria A_1, \dots, A_n

$$\begin{array}{c}
 A_1 \\
 A_2 \\
 \dots \\
 A_n
 \end{array}
 \underbrace{\begin{pmatrix}
 A_1 & A_2 & \dots & A_n \\
 w_1/w_1 & w_1/w_2 & \dots & w_1/w_n \\
 w_2/w_1 & w_2/w_2 & \dots & w_2/w_n \\
 \dots & \dots & \dots & \dots \\
 w_n/w_1 & w_n/w_2 & \dots & w_n/w_n
 \end{pmatrix}}_W
 \underbrace{\begin{pmatrix}
 w_1 \\
 w_2 \\
 \dots \\
 w_n
 \end{pmatrix}}_w
 = n \underbrace{\begin{pmatrix}
 w_1 \\
 w_2 \\
 \dots \\
 w_n
 \end{pmatrix}}_w$$

w_i is the theoretical/absolute weight of criterion A_i in group (A_1, A_2, \dots, A_n)

Theoretical matrix W and Pairwise comparison matrix A

- Matrix W is reciprocal and consistent, i.e. $a_{ij} = 1/a_{ji}$, $a_{ij}a_{jk} = a_{ik}$ while **matrix A may not be consistent**
- W has rank 1 and its max eigenvalue equals n ($\lambda_{max} = n$)
- The largest eigenvalue of A is greater or equal to n
- Consistency Index (CI) of A:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

λ_{max} is A's largest eigenvalue

- Consistency Ratio (CR) of A:

$$CR = \frac{CI}{RI}$$

RI is the Random Index

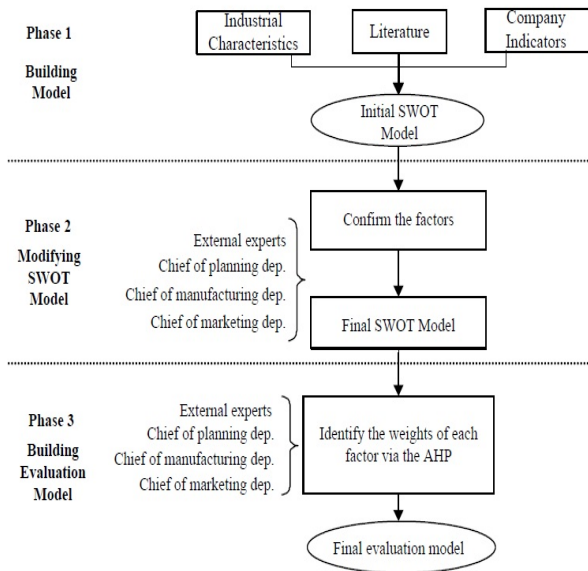
Calculating weights of criteria

- Row Geometric Mean Prioritization Method

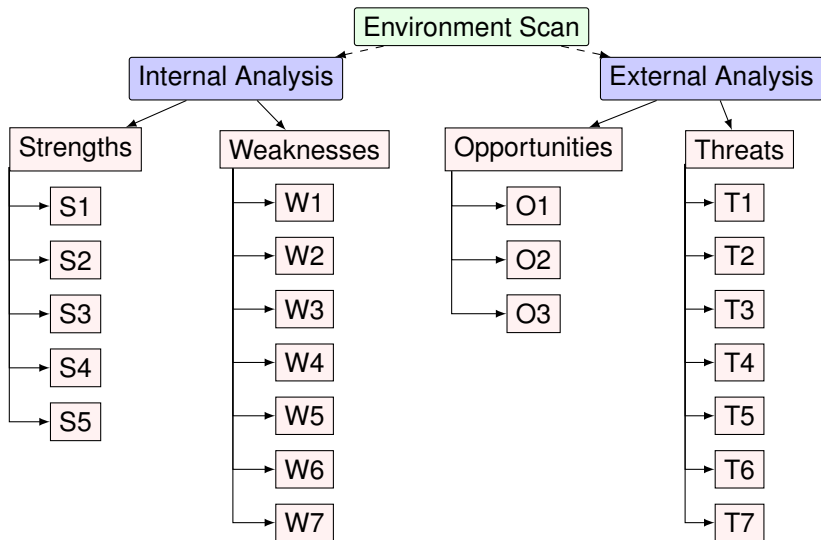
$$w_i = \frac{\sqrt[n]{\prod_{j=1}^n a_{ij}}}{\sum_{i=1}^n \sqrt[n]{\prod_{j=1}^n a_{ij}}}$$

- Normalizing sums over rows with a large power

$$w = \frac{A^k e}{e^T A^k e}, \quad e = (1, 1, \dots, 1)$$



Strengths (S)	Weaknesses (W)
(S1) Innovative capacity	(W1) Lack of performance measurement systems
(S2) Availability of resources and skills	(W2) Non flexible organizational structure
(S3) Quality of the product	(W3) Energy costs
(S4) Expert management staff	(W4) Labor costs
(S5) Reliability in marketplace	(W5) Lack of accurate forecasting capability
	(W6) High logistics costs
	(W7) Lack of well-known own brands
Opportunities (O)	Threats (T)
(O1) Rising living standards and increasing modern buildings	(T1) Macroeconomic instability in Turkey
(O2) Globalization and the decreased trade barrier	(T2) Competition
(O3) New foreign markets	(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



OVERALL PRIORITY SCORES OF SWOT FACTORS

Swot Group	Group Priority	Swot Factors	Factor Priority within the Group	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 standarts 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 in Turkey	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

REFERENCES

[1] Ali Gorener, Kerem Toker, Korkmaz, Ulucay, Application of Combined SWOT and AHP: A Case Study for a Manufacturing Firm, Social and Behavioral Sciences 58 (2012) 1525-1534.

[2] Thomas L. Saaty, How to make a decision: The Analytic Hierarchy Process, European Journal of Operational Research 48 (1990) 9-26.