

# Presentation of Automobile Part Making Companies Strategy by Applying SWOT and ANP Model (Case study: Automobile part making companies in Iran)

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## ABSTRACT

Nowadays automotive part making companies according to environmental and competitive conditions should choose appropriate strategy for its survival or growth in industry. In this study first with examine internal and external environment and identify of best factors effect on future of part making companies with offer strengths and weaknesses, opportunities and threats provided SWOT matrix for the industry but since the SWOT analysis isn't able to determine the quantitative importance of each factor and does not introduce a mechanism for evaluating options. Thus we can use the method of multiple criteria decision making for some options. Method of Analytical Hierarchy Process (AHP) resolves some weaknesses of the SWOT technique but dependency between SWOT factors causes actually that this method is inefficient to obtain alternative strategy. Therefore, considering the dependence of the SWOT was used method of analysis network process (ANP) and its results are presented.

**Keywords:** Strategic Planning, Part Making Companies Strategy, SWOT, ANP, MCDM

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## 1- INTRODUCTION

It should be noted that automotive parts makers have role of crucial and determinant in the manufactured products quality of automotive-makers. More than 1,200 units of part making are working in Iran that 30 units are large and each of the 30 units can be worked with many small part makers and provide 70% automobile parts in Iran. Currently auto making companies to reduce their production costs and enhance production quality, parts needed for their production leave to automotive parts making companies. Although most of these companies are small companies but according to their large number, their share of job creation is more than auto making companies. These companies should be able to find required strategies for their growth and survival in a vibrational market. Companies Management by using all organizational levels must deal with to collect information and companies determine how wants to create value to the shareholders, customers and citizens. Managers prior strategies developed should analysis competitive dynamics in the industry and the company's internal resources and capabilities and achieve a clear understanding towards it. So is used SWOT analysis that summarize the most important internal and outside factors in the organization (this factors is known as strategic factors affecting to the future of this organization). In this study following to determine alternative strategies in order the ranking and selection of the best strategies was used from method based on Analytical Hierarchy Process (ANP) and its results is presented.

## 2 - Theoretical Foundations of Research

Many and different methods can be used for strategic analysis. The SWOT analysis is an important tool for decision support that it is for analysis the internal and external environments of organization (Kangas et al. 2003). SWOT analysis finds most important internal and external factors of organization and then it will summarize them. These factors are known as affective strategic factors on organization future. SWOT analysis in measurement and evaluation processes has some shortage. Factors are introduced in SWOT but their importance and value will be covered ours. So we need other complementary method for the evaluation and selection. Many Methods and techniques have been used so far, such as AHP method. Although AHP techniques can be resolve some of the shortages assessment and measurement process, but it is not able to evaluate among factors possible the dependence (Yüksel & Dağdeviren, 2007). AHP method assumes that considered factors are

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independent in the hierarchical structure, while this assumption is not always rational. Through the analysis of internal and external environments can be realized possible dependencies among factors. So if having a dependency among SWOT factors actually AHP method will be invalid for calculations.

**2-1: ANP**

ANP is more general and complete model than AHP that gives allow analysis of different issues with interactions data between elements (Saaty, 2001, p.5). Also these interactive communications are called sometimes a feedback system. To calculate the weight of these issues was developed a method as super-matrix (Saaty, 1996, p.16). Super-matrix adjusted effect of weights associated elements together to consider the matrix with the company all the options and elements.

**2-2 The difference between the two techniques from Saaty (1999) Viewpoint is:**

- ANP with the permitting dependence goes beyond from AHP that is the only independent case.
- ANP is associated to dependence of elements in a set and dependence of elements in different sets (external dependence).
- ANP network structure allows to the researcher that issue decisions will design without worrying about what comes first and what later.
- ANP is a non-linear structure while AHP with a goal at the highest level, the options on the bottom level, have a linear structure.
- ANP not only elements, but also groups or clusters of elements will be arranged in terms of priority right.

**2-3- Combined Network Analysis Process (ANP) with SWOT**

The first step is making of model and organizing of problems: Problem should express as clear and is analyzed as a rational system a network.

The second phases performed pairwise comparisons and calculate the vector: pairwise comparisons are for to obtain the relative importance of each factor and effective indicators in the selecting goal. To complete matrix of pairwise comparisons is used the numbers until relative importance of one element to another element show in intended character. In this comparison for each of difference related to the binary elements are considered value of 1 to 9 (Saaty, 2001B, p. 71). Use of this scale in a context of social, psychological or political, is expressed first interactive judgment and then this judgment is returned to numerical value. Thus in comparison of element i with element j, importance i on j is one of the conditions in Table 1. In addition, a scale of two-way or mutual are considered for comparison reverse that in it is used  $a_{ij} = \frac{1}{a_{ji}}$  the pairwise comparisons for inner dependence of index.

Table 1- Saaty’s 1–9 scale for AHP preference (Saaty, 1996)

<b>Extremely preferred</b>	<b>9</b>
Very strongly preferred	<b>7</b>
Strongly preferred	<b>5</b>
Moderately preferred	<b>3</b>
Equally preferred	<b>1</b>
Intermediate values	<b>2,4,6,8</b>

In most cases, the decision maker is a particular individual and sometimes group of managers decided about particular subject. A group decision making has three special cases: 1. decision making with the unanimous and consensus 2. Decision making each of members individually and then combining results 3.Members decision making who have different weights to individually (Asgharpour, 2006)

The next step is formation of super matrix. Super-matrix used for the analysis of inner dependence between systems components. Super-matrix is a matrix composed that sub-matrix includes a set of relations between inside level that will displayed by the decision maker. Super-matrix elements were obtained from pairwise comparisons matrix of inner dependence and is replaced in it. Each non-zero value in the super-matrix indicates to the relative importance of obtained weight from pairwise comparisons matrices of inner dependence and in next step should gain each column in the matrix as a vector potential to achieve the goal. Exponentiation Matrix will cause convergence and it power will as  $2K + 1$  (K is large and optional number)

The final step selecting the best decision is based on achieved weight.



For use of ANP is usually used the super-matrix . For example, below figure super matrix a SWOT hierarchy 4-level is as follows that in it super-matrix of  $w_1$  is a vector that goal impact shows on the main factors of SWOT.  $W_2$  is matrix that expresses an inner dependence of the main factors SWOT.  $W_3$  is matrix that represents effect of the main factors of SWOT on each of SWOT sub-factors.  $W_4$  is matrix that shows effect of the SWOT sub-factors on each of the alternatives (Yüksel & Dağdeviren, 2007)

$$W = \begin{matrix} & \text{goal} & & & & \\ & \text{SWOT factors} & & & & \\ & \text{SWOT sub-factors} & & & & \\ & \text{alternatives} & & & & \end{matrix} \begin{bmatrix} 0 & 0 & 0 & 0 \\ w_1 & W_2 & 0 & 0 \\ 0 & W_3 & 0 & 0 \\ 0 & 0 & W_4 & I \end{bmatrix},$$

Figure 2- the general sub-matrix notation for the SWOT model used in this study is as follows

It should be noted that also, instead of the super-matrix method can used matrix operations especially when the number of interconnections are less. (Yüksel & Dağdeviren, 2007) and also in this study we have used method of matrix operations.

**4- Analyze Model and the importance weight of each factor**

First step: Start with regard form of model by assuming lack of inner dependence among the major factors SWOT are formed pairwise comparison matrix of main factors using a scale of 1 to 9 by experts and form the obtained weights of  $w_1$  matrix.

Table 3-Pairwise comparison of SWOT factors by assuming that there is no dependence among them

SWOT factors	S	W	O	T	Relative importance weights ( $w_1$ )
S	1	1.5	2	0.75	0.288
W		1	1.8	0.48	0.207
O			1	0.55	0.149
T				1	0.356
CR=0.02					

Second step: in this step pairwise comparison of main factors is calculated with the inner dependence impact (influence factor on other factors) according to Figure 2 and obtained  $w_2$  matrix.

$$w_2 = \begin{bmatrix} 1 & 0.329 & 1 & 0.583 \\ 0.326 & 1 & 0 & 0.417 \\ 0.25 & 0 & 1 & 0 \\ 0.424 & 0.671 & 0 & 1 \end{bmatrix}$$

Table 4-The inner dependence matrix of the SWOT factors with respect to ‘‘Strengths’’

Strengths	W	O	T	Relative importance weights
W	1	1.4	0.71	0.326
O		1	0.63	0.250
T			1	0.424
CR=0.01				

Table 5- The inner dependence matrix of the SWOT factors with respect to ‘‘Weaknesses’’

Weaknesses	S	T	Local weights
Strengths	1	0.49	0.329
Threats		1	0.671
CR=0			

Table 6-The inner dependence matrix of the SWOT factors with respect to ‘‘Threats’’

Threats	s	w	Local weights
Strengths	1	1.4	0.583
Weaknesses		1	0.417
CR=0			

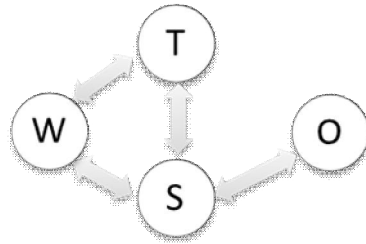


Figure 3 - Dependence between the main factors SOWT

Third step: from obtained weight in previous step form  $W_2$  matrix and matrix intended in pairwise comparisons multiply at main factors  $W_1$ . This action shows impact of dependence into the main factors.

$$\begin{matrix} s \\ w \\ o \\ t \end{matrix} \begin{bmatrix} 1 & 0.329 & 1 & 0.583 \\ 0.326 & 1 & 0 & 0.417 \\ 0.25 & 0 & 1 & 0 \\ 0.424 & 0.671 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 0.288 \\ 0.207 \\ 0.149 \\ 0.356 \end{bmatrix} = \begin{bmatrix} 0.356 \\ 0.225 \\ 0.110 \\ 0.309 \end{bmatrix}$$

Step Four: Pairwise comparisons do for sub factors and calculate the relative weight of each and because many calculation, it is given in Appendix 1 of paper end.

Step Five: obtained weight of the main factors (with impact of dependence) multiplying in obtained weight sub factors in the previous step and overall weight of sub factors will be achieved.

Table 7- SOWT matrix

Priority of the factors	Priority of the sub-factors	Overall priority of the sub-factors ( $W_3 = W_{sub-factors\ global}$ )
$s = 0.356$	0.183	0.65
	0.245	0.9
	0.347	0.123
	0.225	0.08
$w = 0.225$	0.163	0.037
	0.455	0.102
	0.05	0.011
	0.074	0.165
	0.258	0.058
$o = 0.11$	0.277	0.03
	0.163	0.018
	0.210	0.023
	0.35	0.038
$t = 0.309$	0.199	0.061
	0.174	0.054
	0.281	0.087
	0.054	0.017
	0.293	0.165

Step Six: At this stage alternative strategy with any of sub-factors pairwise comparisons and is achieve as  $w_4$  matrix. (Calculations can be seen in Appendix 2.)

$$W_4 = \begin{bmatrix} 0.254 & 0.254 & 0.375 & 0.296 & 0.164 & 0.178 & 0.108 & 0.117 & 0.161 & 0.304 & 0.314 & 0.262 & 0.256 & 0.143 & 0.274 & 0.176 & 0.299 & 0.289 \\ 0.216 & 0.265 & 0.204 & 0.270 & 0.215 & 0.261 & 0.249 & 0.248 & 0.234 & 0.218 & 0.211 & 0.284 & 0.168 & 0.149 & 0.218 & 0.192 & 0.268 & 0.266 \\ 0.345 & 0.308 & 0.306 & 0.253 & 0.226 & 0.273 & 0.328 & 0.322 & 0.304 & 0.281 & 0.288 & 0.320 & 0.327 & 0.440 & 0.312 & 0.469 & 0.243 & 0.256 \\ 0.286 & 0.172 & 0.116 & 0.281 & 0.395 & 0.297 & 0.315 & 0.318 & 0.311 & 0.197 & 0.192 & 0.164 & 0.284 & 0.268 & 0.195 & 0.144 & 0.198 & 0.229 \end{bmatrix}$$

And in the last step Matrix of pairwise comparisons with alternative strategies with each of sub-factors in obtained overall weight are multiplied for sub-factors.

$$W_{alternatives} = \begin{bmatrix} SO \\ WO \\ ST \\ WT \end{bmatrix} = W_4 \times W_{sub-factors\ (global)} = \begin{bmatrix} 0.254 \\ 0.229 \\ 0.328 \\ 0.219 \end{bmatrix}$$

As can be seen most of the weight allocated to the strategy ST and indicates that companies to choose the best strategy should be selected Cost reduction strategies of Products final cost, Increase customers and receive new orders and develop strategies to overcome international sanctions.

**RESULT**

It should be noted that achieving to key factors of organization is not possible except by with study and control of organizations and its environment that has enclosed it. In this paper we focus on introduce the factors listed for part making companies of automotive in the SWOT matrix and in this way due to possible dependencies between the factors have used the approach (ANP). The best strategy for the future of part making companies is known strategy of ST and companies must offer competitive strategy by reducing the cost of finished products and are trying to attract new customers and also solutions in reducing the effects of international sanctions that directly and indirectly will have a negative impact on the majority of manufacturing industries in Iran.

Appendix A. Pairwise comparison matrices for SWOT sub-factors local priorities

strengths	S1	S2	S3	S4	Local weights
S1	1	1.2	0.5	0.5	0.183
S2		1	0.87	1.43	0.245
S3			1	2	0.347
S4				1	0.225
CR=0.06					

weaknesses	W1	W2	W3	W4	W5	Local weights
W1	1	0.29	4	2	0.7	0.163
W2		1	8	5	2	0.455
W3			1	0.7	5	0.05
W4				1	0.22	0.074
W5					1	0.258
CR=0.01						

opportunities	O1	O2	O3	O4	Local weights
O1	1	3	1.2	0.44	0.277
O2		1	0.95	0.67	0.163
O3			1	0.8	0.210
O4				1	0.350
CR=0.09					

Threats	T1	T2	T3	T4	T5	Local weights
T1	1	2	0.45	5	2.4	0.199
T2		1	1.1	2	0.8	0.174
T3			1	6	1	0.281
T4				1	0.2	0.554
T5					1	0.293
CR=0.07						

Appendix B. Pairwise comparison matrices for the priorities of the alternative strategies based on the SWOT subfactors

S1	SO	WO	ST	WT	Local weights
SO	1	1.1	0.82	1.3	0.254
WO		1	0.63	1.08	0.215
ST			1	2.1	0.345
WT				1	0.186
CR=0					

S2	SO	WO	ST	WT	Local weights
SO	1	1.05	0.79	1.4	0.254
WO		1	0.94	1.54	0.265
ST			1	1.89	0.308
WT				1	0.172
CR=0					

S3	SO	WO	ST	WT	Local weights
SO	1	2	0.91	4	0.375
WO		1	0.64	2.1	0.204
ST			1	1.85	0.306
WT				1	0.116
CR=0.03					

S4	SO	WO	ST	WT	Local weights
SO	1	0.93	1.24	1.81	0.296
WO		1	1.01	1.33	0.270
ST			1	1.42	0.253
WT				1	0.181
CR=0.01					

W1	SO	WO	ST	WT	Local weights
SO	1	0.85	0.62	0.43	0.164
WO		1	0.91	0.64	0.215
ST			1	0.27	0.226
WT				1	0.395
CR=0.01					

W2	SO	WO	ST	WT	Local weights
SO	1	0.79	0.63	0.55	0.178
WO		1	0.91	0.94	0.251
ST			1	0.82	0.273
WT				1	0.297
CR=0					

W3	SO	WO	ST	WT	Local weights
SO	1	0.48	0.31	0.33	0.108
WO		1	0.91	0.71	0.249
ST			1	1.19	0.328
WT				1	0.315
CR=0.01					

W4	SO	WO	ST	WT	Local weights
SO	1	0.46	0.39	0.67	0.117
WO		1	0.89	0.61	0.242
ST			1	1.28	0.322
WT				1	0.318
CR=0.01					

W5	SO	WO	ST	WT	Local weights
SO	1	0.73	0.65	0.41	0.161
WO		1	0.83	0.68	0.224
ST			1	1.32	0.304
WT				1	0.311
CR=0.01					

O1	SO	WO	ST	WT	Local weights
SO	1	1.79	0.94	1.35	0.304
WO		1	0.85	1.28	0.218
ST			1	1.4	0.281
WT				1	0.197
CR=0.01					

O2	SO	WO	ST	WT	Local weights
SO	1	1.18	1.63	1.32	0.314
WO		1	0.63	1.07	0.211
ST			1	1.81	0.283
WT				1	0.192
CR=0.03					

O2	SO	WO	ST	WT	Local weights
SO	1	1.18	1.63	1.32	0.314
WO		1	0.63	1.07	0.211
ST			1	1.81	0.283
WT				1	0.192
CR=0.03					

O3	SO	WO	ST	WT	Local weights
SO	1	1.12	0.84	1.43	0.262
WO		1	0.81	1.65	0.254

ST			1	2.05	0.320
WT				1	0.164
CR=0					

O4	SO	WO	ST	WT	Local weights
SO	1	1.55	0.69	1.11	0.256
WO		1	0.57	1.03	0.193
ST			1	1.26	0.327
WT				1	0.224
CR=0.01					

T1	SO	WO	ST	WT	Local weights
SO	1	1.1	0.22	0.75	0.143
WO		1	0.28	0.84	0.149
ST			1	0.88	0.440
WT				1	0.268
CR=0.08					

T2	SO	WO	ST	WT	Local weights
SO	1	1.31	0.89	1.33	0.274
WO		1	0.73	1.11	0.218
ST			1	1.7	0.312
WT				1	0.195
CR=0					

T3	SO	WO	ST	WT	Local weights
SO	1	0.95	0.28	1.53	0.175
WO		1	0.35	1.63	0.192
ST			1	2.33	0.489
WT				1	0.144
CR=0.04					

T4	SO	WO	ST	WT	Local weights
SO	1	1.15	1.08	1.73	0.299
WO		1	1.02	1.36	0.258
ST			1	1.05	0.245
WT				1	0.198
CR=0.01					

T5	SO	WO	ST	WT	Local weights
SO	1	1.73	0.94	1.1	0.289
WO		1	0.91	1.26	0.226
ST			1	1	0.256
WT				1	0.229
CR=0.02					

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