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An application of ANP for ranking different factors influencing on demand for auto parts

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A B S T R A C T

This paper presents an empirical investigation to study different factors influencing auto parts in different regions of Iran. The study has asked some experts who worked for the biggest auto parts supplier named SaipaYadak to express their insights about important factors influencing demand for auto parts in different region and their insights have grouped into four categories of parts related issues, weather conditions, regional as well as cultural factors. The study has been applied in five different regions of country including central, south, north, west and east. The study has used analytical network process (ANP) to rank different factors and the results indicate that regional factors is the most important item followed by cultural issues, auto parts and weather conditions.

1. Introduction

There are different advantages on having car in people's life and leisure. One advantage of owning a car is to have our own transportation to when and where we wish. Another advantage to owning a car is the feeling of accomplishment that comes with owning a good item. There are over 60 million cars produced on the market and one primary need is to have the access to necessary auto parts. An auto part supplier has to know more about demand and different factors influencing it (Scherer, 1982). In fact, demand for auto parts may depend on various factors including weather condition, road conditions, etc. (Klier & Rubenstein, 2006). Lai et al. (2008) presented a technique for packaging system assessment, which considers the division manager's span of control, addressed the design of packaging and the corresponding logistics processes, and incorporated both cost and environmental effects. They also used a framework to illustrate the implementation of a case study of a major US automaker. According to Santucci (1997), auto industry has shifted from a regional industry to a global industry and the original equipment supplier base has been pulled in the same direction. The globalization process has paralleled the consolidation of the supplier base that has occurred. There are

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several reasons for sharing the risk associated with automakers since the sector has to handle various issues (Tabeta & Rahman, 1999). Türkcan (2011) examined the development of vertical intra-industry trade (IIT) in the auto-parts industry as an indicator for international fragmentation of the production process between Austria and its 29 trading partners, and different country-specific factors recommended by the fragmentation literature were examined based on some panel econometrics as well as some historical data over the period 1996-2006. They reported that a substantial portion of IIT in the Austrian auto-parts industry was vertical IIT.

2. The proposed study

One of the issues of production planning in auto parts industry is to find important factors influencing demand including weather conditions, regional factors, etc. Saipa Yadak Company was established in 1992 to supply spare parts and after-sales services for an automaker firm named Saipa. Saipa Yadak has applied a supporting method of development by performing warranty policies while being active in international commercial world of spare parts at the same time, which allows SAIPA updating its after-sale industry and developing its network in the world. The proposed study of this paper first has asked 45 experts to determine important factors influencing demand for auto parts and 19 factors have been determined summarized in Table 1 as follows,

Table 1
Different factors influencing demand for auto parts

Road accidents	City road conditions	Car guarantee terms
City accidents	Auto parts life cycle	Culture of how to use cars
Humidity	Auto parts usage	Culture of how to repair cars
Weather dryness	Quality of auto parts	Distance from other cities
Temperature	Methods of sales, pulls versus push	Embargo and political affairs
Price	Quality of car produced	
Road conditions	Auto parts guarantee conditions	

As we can observe from the results of Table 1, there are 19 items influencing demand for auto parts in Iran. After performing an in-depth discussion, we have reduced the items into 12 factors summarized in Table 2 as follows.

Table 2
The summary of 12 factors influencing demand for auto parts

Road accidents	Highway conditions	Quality of auto parts
Weather conditions	Auto parts life cycle	Methods of sales, pulls versus push
City road conditions	Auto parts usage	Culture of how to repair cars
Auto parts guarantee conditions	Car guarantee terms	Culture of how to use cars

Next, we have used factor analysis to group these factors and the results are summarized in Table 3 as follows,

Table 3
The results of factor analysis

Factor	1	2	3	4
Car guarantee terms	.963			
Auto parts usage	.927			
Quality of auto parts	.870			
Culture of deriving				.853
City road conditions			.809	
Auto parts guarantee	.777			.477
Life cycle	.764			
Number of accidents			.966	
Weather conditions		.907		
Highway road conditions			.896	
Sales methods				.835
Culture of repairing car				-.807

According to the results of Table 3, the first group consists of 5 items including car guarantee terms, auto parts usage, quality of auto parts, auto parts guarantee and life cycle and we name it auto parts group. The second item consists of one item named weather conditions. The third group includes three factors including city road conditions, number of accidents and highway road conditions and we name this group as regional factors. Finally, the last group consists of culture of deriving, auto parts guarantee and sales methods and named as cultural factors. The study has applied Pearson correlation test as well as t-student to examine the effects of these factors and Table 4 shows details of our findings.

Table 4
The summary of Pearson correlation and t-student test on the effects of different factors on demand for auto parts

Factor	Pearson correlation	t-student	Result
Auto parts related issues	0.8936	3.4482	Confirmed
Weather condition	0.8536	2.8388	Confirmed
Regional factors	0.9396	4.7568	Confirmed
Cultural factors	0.8542	2.8456	Confirmed
Total	0.9278	4.3079	Confirmed

According to the results of Table 4, all four factors individually and combined influence on demand for auto parts.

3. Analytical network process

Next, we have used analytical network process (ANP) (Saaty, 2001, 2004) to rank different factors based on their relative importance. Table 5 demonstrates the results of our survey for ranking various factors in terms of five regions.

Table 5
The summary of ranking of different factors associated with auto parts based on ANP method

Sub-component	North		South		East		West		Center	
	Weight	Rank	Weight	Rank	Weight	Rank	Weight	Rank	Weight	Rank
Guarantee	0.098	5	0.073	5	0.098	5	0.253	2	0.172	3
Parts usage	0.2	3	0.249	2	0.217	2	0.178	3	0.284	2
Quality	0.319	1	0.282	1	0.386	1	0.095	5	0.114	5
Parts guarantee	0.102	4	0.166	4	0.146	4	0.183	4	0.302	1
Life cycle	0.281	2	0.23	3	0.153	3	0.291	1	0.128	4

The results of Table 5 indicate that auto parts' quality and life cycle play essential role for demand in all regions of the country. Similarly, Table 6 shows the results of the implementation of ANP method for ranking various factors associated with regional factors.

Table 6
The summary of ranking of regional factors based on ANP method

Sub-component	North		South		East		West		Center	
	Weight	Rank	Weight	Rank	Weight		Weight	Rank	Weight	Rank
Road conditions	0.317	2	0.364	1	0.308	3	0.402	1	0.351	2
Highway conditions	0.394	1	0.299	3	0.357	1	0.385	2	0.212	3
Accidents	0.289	3	0.337	2	0.335	2	0.213	3	0.437	1

According to the results of Table 6, highway conditions and the numbers of accidents are important factors influencing demand for auto parts. Finally, Table 7 shows details of ranking the cultural affairs. According to the results of Table 7, driving culture is number priority for demand on auto parts followed by sales methods and maintenance issues.

Table 7
The summary of ranking of cultural factors based on ANP method

Sub-component	North		South		East		West		Center	
	Weight	Rank	Weight	Rank	Weight	Rank	Weight	Rank	Weight	Rank
Driving culture	0.471	1	0.46	1	0.369	1	0.488	1	0.448	1
Maintenance	0.099	3	0.215	3	0.34	2	0.239	3	0.265	3
Sales methods	0.43	2	0.325	2	0.291	3	0.273	2	0.287	2

4. Conclusion

In this paper, we have presented an empirical investigation to study the impact of different factors on demand for auto parts in Iran. The study has applied analytical network process to rank different factors and categorized them in terms of four groups of auto parts related, regional issues, weather conditions and cultural factors. In terms of auto parts and their components, quality and life cycle play the most important role while in terms of regional affairs, highway conditions and the numbers of accidents are important factors influencing demand for auto parts. Finally, cultural affairs are the last component of the survey where driving culture is number priority for demand on auto parts followed by sales methods and maintenance issues.

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