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Determination of Preference Ranking of Fast Food Companies with Analytic Hierarchy Process: An Application in Dumlupinar University

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Abstract
This study aimed to determine students at Dumlupınar University Faculty of Economics and Administrative Sciences International Trade and Finance of preference ranking of fast food company with Analytic Hierarchy Process (AHP). For this purpose, five criteria was determined and six fast food companies in Sera Kütahya shopping center has been discussed as an alternative. A questionnaire was presented to 169 students who determined by sampling method and selected randomly. According to the scores given by the students, the most important criteria of prefering fast food firms was product taste and freshness and less important than others was advertising. According to the Analytic Hierarchy Process results, Burger King was found as the most preferred company with a rate of 27.54% among students.
Keywords: Analytic Hierarchy Process, Preference Ranking, Fast Food Companies

1. Introduction

Fast-food is a way of nutrition aroused in urban life areas as a compulsory result of people's sparing less time for nutrition in order to use the time more efficiently. In modern world which requires a mobile life style, fast-food culture has gradually become more popular as the time spent outside increases while the time spared for food decreases (Dalgın and Kızgın, 2012).

Fast-food sector is a system which serves a large amount of customers in a short period of time by preparing and serving food with standardized methods. This system both appeals to the tastes of people who spend most of their time outside and also solves their time problems (Anıl et al., 2011). Food products such as hamburgers, pizzas, sandwiches, kebap, lahmacun (Turkish pizza) and bagels are some examples that can be considered as fast-food products which appeal to different tastes and can be modified according to the nutrition habits of people.

Pillsburry (1990) classified factors that are critical for fast-food sector's development such as below:

* Increasing number of paid-working women
* Increasing number of paid-working women with child under the age of 18
* Increasing ethnic diversity of population
* USA's increasing influence over global economy

In the 15th century, cafes were started to serve in Europe, the word restaurant was used for the first time in Europe in the 18th century and the first restaurant chain was started to spread in USA in 1827 (Ninemeier, 1990:8). In Turkey and in the world, after 1980s in particular, as the restaurant chains spread, expenses per person for food and drink outside started to increase (Bucak, 2012:5). Business volume of fast-food sector which was 16.1 billion dollars in USA in 1975, increased by 900% to 153.1 billion dollars in 2004 (Austin et al., 2005). Fast-food nutrition style that emerged in USA has spread all over the world as an element of modern global culture. Successful activities of international fast-food companies played a great role in fast-food culture's such dissemination (Dalgın and Kızgın, 2012). Not only the request from customers but also the increase in supply sources contributed in the growth of fast-food industry (Korkmaz, 2005).

McDonalds that gave a start to fast-food sector in Turkey in 1986 made sure that the fast-food sector was accepted especially by young customers by providing different types of food with its organizational differences (Bayhan et al., 2015). Educational developments, raised incomes, increases in different product ranges, more consumer-oriented activities as the competition getting more intense and increasing importance of time factor caused fast-food consuming habits to grow (Gül et al., 2003:65). Fast-food products that is prepared and served in locations nearby to schools and campuses are the leading products often preferred by students. Students choose these food products for the same reasons as other consumers; they can be prepared and consumed quickly. Therefore, the main reason of choice is time (Brady et al., 2001: 135).

2. Literature review

With Analytical Hierarchy Process (AHP) providing application possibilities in diverse areas, many studies were conducted and various contributions were made to the literature. However, Saaty, who invented and developed AHP, paid more attention to its theoretical part.

With AHP, different applications are possible in many areas such as manufacturing, marketing,

logistics and engineering. One of the most studied subjects in the literature is the supplier selection. Some of them are listed below:
- Liu and Hai defined supplier selection criteria as quality, flexibility, delivery and cost. At the end of the study, they concluded that this technic is suitable for problems with multi-objective evaluation such as staff selection, performance assessments of individuals or departments.
- Chamodrakas et al. used Fuzzy Analytical Hierarchy Process (FAHP) for supplier selection of online marketplaces. They emphasized to use a fuzzy structure to eliminate possible inconsistencies that can emerge during the modelling of personal choices. In the study, along with main criteria such as quality, cost and delivery, different sub-criteria were defined.
- Bruno et al. used AHP method for supplier selection in Italian railway industry. Main criteria such as process and product quality, service level, administration and innovation, financial status and a number of sub-criteria were defined. Author also stated that in further studies AHP method can be applied considering the fuzzy environments and some combinations are possible with different methods.
- Akman and Alkan conducted a research using FAHP to evaluate the performances of suppliers in supply chain management. Automative sub-industry is selected for the application part of the study. Main criteria such as technical qualification, delivery, quality, service, flexibility, pricing and innovation were considered.
- Kazançoğlu and Ada used BAHP in supplier selection process. In the study, main criteria such as performance and financial criteria were preferred and these criteria were divided in to sub-criteria.
Another subject studied with AHP is plant location decisions. Some studies in which AHP is used to determine plant location are listed below:
- Zahir eliminated some ambiguities with AHP by sorting them according to their priorities.
- Kodalı and Routroy studied plant locations problems in potential facilities in supply chain with AHP method.
- Tzeng et al. used AHP to determine the plant location of a restaurant.
- Burdurlu and Ejder used AHP method to determine the plant location of a company in furniture industry.
- Timor studied on the plant location of a convenience goods store using AHP method.

Along with these studies conducted with AHP, there are some studies with fast-food sector in the literature. Greda conducted a study in 2009 with managers of three major food companies in Poland using a scale consisting criteria such as Benefits, Opportunities, Risks and Costs and aimed to make the optimal selection to increase the quality by using the Analytical Hierarchy Process (AHP) and Analytical Network Process (ANP) methods.

In order to determine the motives behind the fast-food preferences of people living in Adıyaman and Gaziantep, Olcay and Akçi (2014) applied a 25-item scale to 407 people who live in those cities and selected with simple random sampling. They researched if there is a significant relationship between fast-food preferences and independent variables such as gender, age and level of education using Mann-Whitney U and Kruskal Wallis H tests.

Korkmaz (2005) mentioned the fast-food restaurants' competitive strategies and conducted a research in order to reveal what university-level students think about these restaurants and what their preferences are. At the end of the research kebap and lahmacun (Turkish pizza) are found to be the most preferred fast-food products among students and it is determined that students prefer these products because they consider them as hygienic, healthy and of good quality. Besides, it is determined that important factors in purchasing process differ significantly according to gender, income level and the university at which the participants study. Bayhan et al. (2015) determined some criteria used in the selection of fast-food restaurants of Pamukkale University students and in order to make an optimal selection between alternatives according to these criteria, AHP is used and students' preferences of alternatives are sorted.

In their study Dalgın and Kızgın (2012) aimed to identify the reasons why local and international fast-food products are preferred. To this end, they applied a 31-item scale to participants living in Muğla. They found out that demographic variables such as age, gender and income level make differences in their choices of fast-food products and consumption frequencies of participants differ from each other depending on their marital status and awareness level of a healthy life style.

3. Material and method

In this study, it is aimed to identify fast-food preference order of students who study International Trade and Finance at the Faculty Economics and Administrative Sciences at Dumlupinar University. To this end, five criteria are determined and six fast-food restaurants at Sera Kütahya Shopping Mall are considered as alternatives. 169 students who have been selected randomly using the stratified sampling method are presented a questionnaire to fill out.

Six fast-food restaurants at Sera Kütahya Shopping Mall are researched in the scope of the study in order to identify the preference order of students. These restaurants are; Popeyes, Mr. Kumpir, Burger King, McDonald's, Pizza Pizza and Sbarro.

Criteria that are effective during the selection process of students between fast-food restaurants are determined according to the studies in the literature along with circumstances at the shopping mall. These criteria are:

1. Product's price
2. Product's taste and freshness
3. Serving time
4. Employee's attitudes
5. Advertisement

Upon determining the criteria and the alternatives, a questionnaire was prepared and applied to the participants so that they can compare between the criteria and the alternatives. Participants are 169 students who have been selected randomly with stratified sampling method from students studying International Trade and Finance at the Faculty Economics and Administrative Sciences at Dumlupinar University.

In this study, sample size is determined using the equation below:

In the case that population size is known; with a confidence level of 95% and a error margin of 5%.

$$n = \frac{Nt^2pq}{d^2(N-1)+t^2pq} = \frac{286.0{,}5.0{,}5.(1{,}96)^2}{(0{,}05)^2.(286-1)+0{,}5.0{,}5.(1{,}96)^2} = 164{,}19 \cong 165$$

n: Sample size,
N: Population size,
p: Proportion of attributed population elements
q (1-p): Proportion of unattributed population elements
Z_α : α= 1.96, 2.58 and 3.28 values for 0.05, 0.01, 0.001
d = Sampling error
σ= Standard deviation of the population
$t_{\alpha,sd}$ = sd critical t-distribution values with degrees of freedom (sd=n-1). When $t_{\alpha,sd}$ critical values
sd= n-1$\rightarrow$ are 5000 , they can be equal to Z_α values.
Determining the sample size, stratified sampling method is used and sample numbers are calculated for each stratum (class).

Table.1 Sample Numbers of Strata (Classes)

Classes	Morning Education	Evening Education	Total	Sampling size
1	93	85	178	103 (53+50)
2	56	52	108	62 (32+30)
Total	149	137	**286**	**165**

In Table.1 calculated sample numbers for each stratum are shown. More questionnaires than the sample size are given out. Upon eliminating questionnaires with missing and invalid answers, 169 questionnaires are analyzed in the scope of the study. AHP method is applied to the data in order to determine the order of optimal selection between alternatives.

Analytical Hierarchy Process

AHP, one of the multi-criteria decision making methods, is first suggested by Myers and Alpert in 1968 and is named Analytical Hierarchy Process by Thomas Lorie Saaty in 1977. AHP is a mathematical process taking individuals' priorities into account along with evaluating qualitative and quantitative variables simultaneously (Korpela, 1999: 137). AHP is a method that enables making hierarchical decisions (Harker and Vargas, 1987: 1383).

AHP has been frequently employed by decision makers and has successfully assisted them in constructing and analyzing process of decision-making problems in many different fields (Çitli, 2006: 66). The method, in its broadest meaning, provides an approach to determine multi-criteria and significance levels (Can, 2012: 66).

How does Analytical Hierarchy Process work?

a. Creating the hierarchical construction: In order to make decision-making problems less complex, problems are divided into sub-problems using the levels of hierarchical construction. In this sense, a decision hierarchy is constructed. At the top of the hierarchy, there is a clearly stated objective, below, there are criteria directly effecting the objective and at the bottom, there alternatives to be chosen from. Criteria that are broader in scope are divided into sub-criteria to be placed into the hierarchy (Herisçakar, 1999: 241). At the bottom of the hierarchy, there are alternatives. Levels of hierarchical construction can be arranged according to the complexity of the problem and its details (Zahedi, 1986: 97; Millet, 1998: 1199).

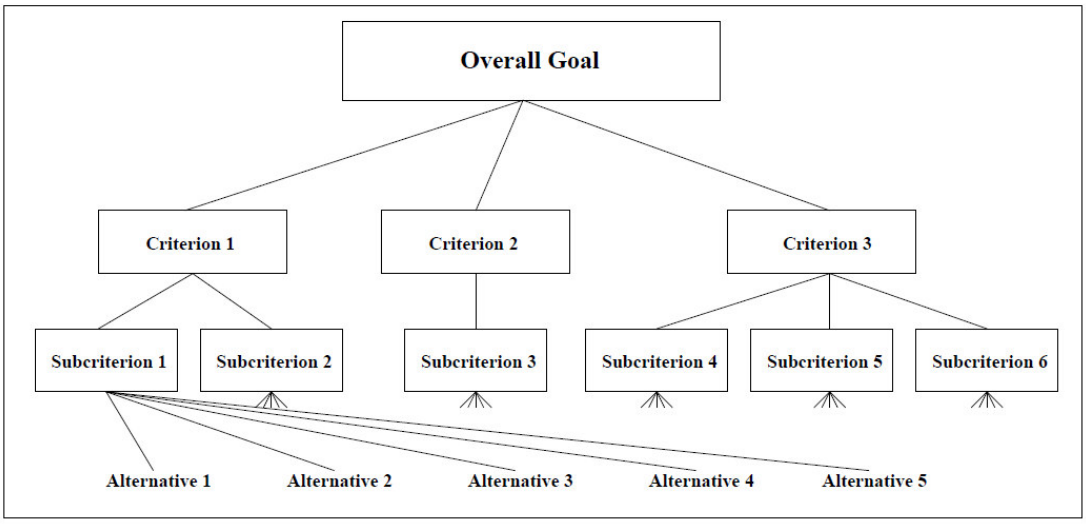

Figure 1. Hierarchical construction of AHP
Resource: Alford B. (2004:6)

General hierarchical construction of the method is as shown in Figure 1 (Çelik, 2007: 66; Alford, 2004:6).

b. Creating pairwise comparison matrix and determining weights: The second stage of AHP is creating pairwise comparison matrix. Creating pairwise comparison matrices, comparative significance degree of each criterion should be calculated, in other words, significance level of criterion A is compared to criterion B should be determined. In order to make pairwise comparison, Saaty's 1-9 scale is used (Evren and Ülengin, 1992: 57; Saaty, 1980). Pairwise comparisons are initially made between criteria and sub-criteria, then according to each criterion, pairwise comparisons between alternatives are realized.

Table.2. 1-9 Scale Used in Pairwise Comparison Method

Significance Level	Definition	Explanation
1	Equal significance	Two elements are equally significant.
3	Moderate significance	One element is slightly more significant than the other.
5	Essential Significance	One element is rather significant than the other.
7	Strong Significance	One element is strongly significant than the other.
9	Very Strong Significance	One element is very strongly significant than the other.
2,4,6,8	Intermediate Values	Intermediate values are used when compromise is needed.

Resource: Saaty (1980)

In Table.2, 1-9 scale used in pairwise comparison is shown.

c. Calculating the consistency ratio Upon determining the comparative significance levels of criteria by calculating the eigenvector, consistency of comparative matrix (CR) has to be calculated. The aim is to determine whether decision maker behaves consistently while making comparisons between criteria. Consistency is determined by calculating the consistency ratio (CR) developed by Saaty.

Table.3. Random Consistency Index Values

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0	0	0,58	0,90	1,12	1,24	1,32	1,41	1,45	1,49	1,51	1,54	1,56	1,57	1,59

Consistency rate is calculated using the formula below:

$\lambda_{max} = proportional\ weight\ of\ the\ matrix$

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

$$TO = \frac{TI}{RI}$$

CI: Consistency Index, RI: Random Consistency Index, n=number of criteria;

RI: Random index introduced by Saaty et al. as a standard correction value in order to calculate the consistency ratio (Table.3).

If the consistency ratio is greater than 0.10, decision maker should review the values entered into the matrix because of inconsistency. In other words, the closer CR is to 0, the higher consistency the matrix has (Saaty, 2000).

d. Making Decision: The final stage of AHP method is the process of making selection between alternatives according to the results of pairwise comparison matrices obtained from criteria and alternatives.

4. Findings and discussion

Implementing the questionnaire to participating students, geometric mean of each student's values given to pairwise comparisons. The reason behind this is to convert these pairwise comparisons into numerical values to represent each participant. Obtaining these values, Analytical Hierarchy Process Super Decision software is used to determine fast-food restaurant preference order of participating students.

Table.4. Weight Values and Importance Orders of Criteria

Criteria	**Weight values**	**Importance order**
Product's taste and freshness	0,50735	1
Product's price	0,16289	2
Employee's attitudes	0,14855	3
Serving time	0,12817	4
Advertisement	0,05304	5
Consistency rate (CR) =0,05385		

As a result of this process, weight values and importance orders of criteria are shown in Table.4. As can be seen clearly from the table, the most important criteria for participating students in fast-food restaurant selection is product's taste and freshness with 50.735%. Following criteria are product's price with 16.289%, Employee's attitudes with 14.855% and Serving time with 12.817%. The least important criterion for participating students in preference order is advertisement with 5.304%.

Table.5. Values of Alternatives According to Criteria

Alternatives/Criteria	Product's taste and freshness	Product's price	Employee's attitudes	Serving time	Advertisement
Burger King	0,25573	0,28027	0,31226	0,28135	0,33166
Mc Donalds	0,17450	0,14013	0,21608	0,22198	0,23339
Mr. Kumpir	0,09758	0,11358	0,11231	0,11099	0,06737
Pizza Pizza	0,16109	0,14381	0,10103	0,12250	0,09030
Popeyes	0,11059	0,14013	0,12086	0,12250	0,14316
Sbarro	0,20052	0,18208	0,13746	0,14067	0,13411
Consistency ratios	***0,03054***	***0,02177***	***0,01410***	***0,01738***	***0,01812***

Determining the weight values of criteria, values of alternatives resulting from pairwise comparisons according to these criteria are shown in Table.5. In Table.5, each alternative's pairwise comparison results according to criteria are shown. According to this table, consistency ratio of all pairwise comparison matrices is below 0.10; therefore, all pairwise comparisons are considered consistent.

Table.6. Prefence Order of Fast-Food Companies

Alternatives (Companies)	**Weighted results**	**Order of preference**
Burger King	0,27543	**1**
Mc Donalds	0,18429	**2**
Mr. Kumpir	0,10249	**6**
Pizza Pizza	0,14065	**4**
Popeyes	0,12018	**5**
Sbarro	0,17696	**3**

Evaluating the values of alternatives according to criteria and weight values of criteria together, preference order of fast-food restaurants is generated. Results are shown in Table.6. As a results of AHP, the most preferred fast-food restaurant by participating students is Burger King with 27.543%. There are slight differences between other fast-food restaurants. This means that participating students' preferences, except for their first choice, do not differentiate from others.

5. Results and suggestions

Analytical Hierarchical Process is one of multi-criteria decision making methods that have been frequently employed by decision makers while making selections between alternatives according to some criteria. In this study, 6 fast-food restaurants at Sera Kütahya Shopping Mall are approached in order to determine the preference order of students studying International Trade and Finance at the Faculty of Economics and Administrative Sciences at Dumlupinar University. Five criteria are determined given the circumstances at the shopping mall and the studies in the literature.

169 students who have been selected randomly using the stratified sampling method are presented a questionnaire to fill out. Analytical hierarchy process is applied to the data obtained from the questionnaires and

product's taste and freshness is found to be the most important criterion with 50.735% for participating students in fast-food restaurant selection. Following criteria are product's price with 16.289%, employee's attitudes with 14.855% and serving time with 12.817%. The least importance criterion for participating students in preference order is advertisement with 5.304%.

Upon applying the analytical hierarchy process, as can be seen in Table.6, Burger King is found out to be the most preferred fast-food restaurant by participating students with 27.543%. When all criteria are investigated, Burger King is found to be the optimum fast-food restaurant for participating students. McDonalds is found to be the second alternative. Therefore, it can be concluded that the most preferred fast-food products by participating students are hamburgers and similar products.

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