

## An Empirical Study on the Preference of Fast Food Restaurants in Malaysia with AHP-TOPSIS Model

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**Abstract:** The demand for fast food service is increasing dramatically now a days. Therefore, fast food restaurants are becoming the most visiting spot among the people. Fast food service plays an important role in this fast-paced world. Fast food restaurant is a provider of foods and beverage to the customers. McDonald, Kentucky Fried Chicken (KFC), Pizza Hut, Domino Pizza and Wing Zone are the main fast food restaurants in Malaysia. Price, customer service, environment, efficiency, flexibility and location are the major decision criteria in the selection of fast food restaurants. The objective of this paper is to determine the most preferred fast food restaurant among McDonald, KFC, Pizza Hut, Domino Pizza and Wing Zone with Analytic Hierarchy Process-Technique for Order of Preference by Similarity to Ideal Solution (AHP-TOPSIS) Model. Besides that, this study aims to identify the priority of decision criteria in the selection of fast food restaurants. AHP-TOPSIS Model is a decision making or business model which helps to identify the best alternatives based on multiple criteria. The results of this study show that McDonald is the most preferred fast food restaurant followed by KFC, Pizza Hut, Wing Zone and Domino Pizza. Furthermore, environment, customer service and efficiency are the most influential decision criteria in this study. The significance of this study is to identify the most preferred fast food restaurant in Malaysia and the most important criteria in decision making process. AHP-TOPSIS Model can be applied as a business model for the less favourable fast food restaurants to identify their potential improvements based on the most influential criteria in this study.

**Key words:** Multi-criteria decision making, AHP-TOPSIS Model, fast food restaurants, preference, potential, McDonald

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### INTRODUCTION

Fast food restaurant is a provider of foods and beverage to the customers. McDonald, Kentucky Fried Chicken (KFC), Pizza Hut, Domino Pizza and Wing Zone are the main fast food restaurants in Malaysia. Based on the past studies, price, customer service, environment, efficiency, flexibility as well as location are the main decision criteria for the selection of fast food restaurants. The objective of this study is to determine the most preferred fast food restaurant among McDonald, KFC, Pizza Hut, Domino Pizza and Wing Zone by using Analytic Hierarchy Process-Technique for Order of Preference by Similarity to Ideal Solution (AHP-TOPSIS) Model. Besides that, this study also aims to identify the priority of the decision criteria in the selection of fast food restaurants. AHP-TOPSIS Model is a decision making model which helps to identify the best alternatives based on multiple criteria (Velasquez and Hester, 2013).

**Literature review:** Tsai *et al.* (2007) studied the comparison of the service quality of fast food chain franchises in Taiwan. Service quality is very important to attract customers in this highly competitive fast food industry nowadays. The results showed that the overall service quality was affected by several criteria which are customer service, efficiency and environment. In this study, they found that the KFC and McDonald achieved the best performance in terms of environment and efficiency.

Min and Min (2011) have done a research on investigating the service quality of the fast food restaurant franchises in USA. They discovered that the flexibility criterion was the main factor to the customers. This is because the customers were more favourable to easily accessible and national fast food restaurant rather than less accessible, relatively new and regional counterparts. Ehsan (2012) studied the selection of fast food restaurant among the undergraduate students in

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Pakistan. Based on the results, the most important factors in the selection of fast food restaurants were price and efficiency.

Min and Min (2013) studied the evaluation of comparative service quality of fast food restaurants in Korea and USA. The findings of this study showed that the location and price of the fast food were the significant factors to US customers whereas the customer service was the most influential factor in the selection of fast food restaurant among Korean customers.

Untaru and Ispas (2014) studied the preference of young customers for a local fast food restaurant in comparison with an international fast food restaurant. The results showed that the young customers considered the environment, price and customer service as the top priority in the selection of fast food restaurant.

Oni and Matiza (2014) investigated the influential factors that affect the customer choice of fast food restaurant in America. The result revealed that the price, location, customer service and efficiency were the significant criteria that influenced the choice of American fast food restaurant.

Thakkar and Thatte (2014) conducted a research on the customer perceptions of fast food restaurant and the result showed that the customers attached great importance to various criteria such as customer service, efficiency and price. Kecek and Gurdal (2016) studied the preference of fast food restaurants among the undergraduate students. The results revealed that price and customer service were ranked as the top influential criteria in the selection of fast food restaurant.

In addition, Wibowo and Tielung (2016) conducted a study to determine the most preferred fast food restaurant based on price, environment, location and efficiency. The results showed that price and environment were ranked as the top influential criteria in the selection of fast food restaurant.

AHP Model has been applied in other fields as well. Lam *et al.* (2015) studied the preference in the selection of mobile network operators in Malaysia based on multiple criteria. Zak (2015) applied AHP Model to make a comparative analysis of supplier's selection problems in different industries. Lam *et al.* (2015) also applied AHP model in the job selection among the undergraduate students. Selection of fast food restaurants is a multi-criteria decision making problem to the customers. In order to make decision, effectively, AHP-TOPSIS Model has been applied in various fields to solve the multi-criteria decision making problem (Karim and Karmaker, 2016; Yildiz and Yildiz, 2015; Mubarak *et al.*, 2013; Bhutia and Phipon, 2012; Maliki and Owens, 2012; Liew *et al.*, 2016). AHP-TOPSIS Model seeks to

identify the best alternative based on multiple criteria. AHP-TOPSIS Model is able to rank the alternatives and obtain the best alternative selection. The best decision alternative selection has the closest distance to the best ideal solution and also has the farthest distance from the worst ideal solution.

Based on the past studies, AHP-TOPSIS Model has been applied in various fields in different countries. However, AHP-TOPSIS Model has not been studied actively for the selection of fast food restaurants in Malaysia. Therefore, this study aims to fill the research gap by studying the selection of fast food restaurants among McDonald, KFC, Pizza Hut, Domino Pizza and Wing Zone in Malaysia with AHP-TOPSIS Model.

## MATERIALS AND METHODS

There are three stages in the selection of fast food restaurants with AHP-TOPSIS Model as shown in Fig. 1.

**Stage 1:** Identify the decision criteria and decision alternatives for the selection of fast food restaurant.

**Stage 2:** Determine the priorities or weights of the decision criteria with AHP.

**Stage 3:** Rank the decision alternatives with TOPSIS and determine the best decision alternative.

In this study, McDonald, KFC, Pizza Hut, Domino Pizza and Wing Zone are selected as the decision alternatives. Price, customer service, environment, efficiency, flexibility as well as location are identified as decision criteria for the selection of fast food restaurants

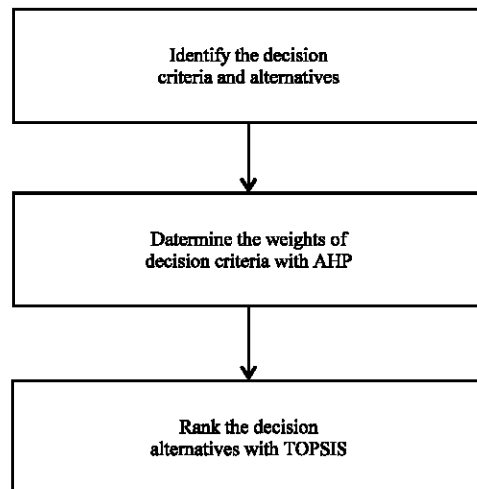


Fig. 1: Three stages in the selection of fast food restaurants with AHP-TOPSIS Model

as shown in Table 1. The data consists of respondents who are the customers of all identified five fast food restaurants in Malaysia.

**Analytic Hierarchy Process (AHP):** AHP is a multi-criteria decision making tool for solving complex decision making problem (Saaty, 1980). In this study, the priorities or weights of the decision criteria in the selection of fast food restaurants are determined by AHP Model. The steps of AHP are shown as follows.

**Step 1:** Construct the pairwise comparison matrix. Each criterion is compared in pairwise in order to obtain its relative importance to the problem. The ratio scale for pairwise comparison (Siew *et al.*, 2015) is presented in Table 2. A pairwise comparison matrix C for n decision criteria is presented:

$$C = \begin{matrix} & C_1 & C_2 & C_3 & \dots & C_n \\ \begin{matrix} C_1 \\ C_2 \\ C_3 \\ \dots \\ C_n \end{matrix} & \begin{bmatrix} 1 & a_{12} & a_{13} & \dots & a_{1n} \\ 1/a_{12} & 1 & a_{23} & \dots & a_{2n} \\ 1/a_{13} & 1/a_{23} & 1 & \dots & a_{3n} \\ \dots & \dots & \dots & \dots & \dots \\ 1/a_{1n} & 1/a_{2n} & 1/a_{3n} & \dots & 1 \end{bmatrix} \end{matrix} \quad (1)$$

**Step 2:** Construct the normalized decision matrix:

$$C_{ij} = \frac{a_{ij}}{\sum_{j=1}^n a_{ij}}, i = 1, 2, 3, \dots, n, j = 1, 2, 3, \dots, n \quad (1)$$

**Step 3:** Construct the weighted normalized decision matrix to determine the priorities or weights of the decision criteria:

$$w_i = \frac{1}{n} \sum_{j=1}^n C_{ij}, i = 1, 2, 3, \dots, n \quad (2)$$

Table 1: Decision criteria for the selection of fast food restaurant

Decision criteria	Symbol
Price	C <sub>1</sub>
Customer service	C <sub>2</sub>
Environment	C <sub>3</sub>
Efficiency	C <sub>4</sub>
Flexibility	C <sub>5</sub>
Location	C <sub>6</sub>

Table 2: Ratio used for pairwise comparison

Scale	Definition
1	A and B are of equal importance
3	A is weakly more important than B
5	A is strongly more important than B
7	A is very strongly more important than B
9	A is absolutely important than B
2, 4, 6, 8	Intermediate values

**Step 4:** Calculate the Consistency Ratio (CR) which is defined in terms of Consistency Index (CI) and Random Index (RI) as follows:

$$CR = \frac{CI}{RI} \quad (3)$$

where, CI is defined as:

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (4)$$

$\lambda_{max}$  is the maximum eigenvalue and n is the number of decision criteria. Table 3 shows the Random Index (RI) with respect to the number of decision criteria (n) (Siew *et al.*, 2015).

If CR is <0.10, the level of consistency in the pairwise comparison matrix is satisfactory and therefore, the result is acceptable.

**Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS):** TOPSIS Model was proposed by Hwang and Yoon (1981) and applied in this study in order to determine the most preferred fast food restaurant. TOPSIS Model is able to rank the decision alternatives and obtain the best alternative. The best alternative has the closest distance to the best ideal solution and also has the farthest distance from the worst ideal solution. The steps of TOPSIS are shown as follows.

**Step 1:** Construct a decision matrix which consists of n decision criteria and m decision alternatives. The score of each alternative with respect to each criterion is given as  $x_{ij}$  and then a decision matrix  $(x_{ij})_{m \times n}$  is formed:

$$(x_{ij})_{m \times n} = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \vdots & \vdots & \dots & \vdots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \quad (5)$$

Table 3: Values of random index

n	RI
2	0.00
3	0.58
4	0.90
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.51

**Step 2:** Construct the normalized decision matrix as follows:

$$r_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^m X_{ij}^2}}, i = 1, 2, \dots, n, j = 1, 2, \dots, m \quad (6)$$

**Step 3:** Construct the weighted normalized decision matrix by multiplying the normalized decision matrix  $r_{ij}$  with the weights  $w_i$  of the decision criteria:

$$t_{ij} = w_i r_{ij}, i = 1, 2, \dots, n, j = 1, 2, \dots, m \quad (7)$$

**Step 4:** Determine the worst ideal solution  $A_w$  and the best ideal solution  $A_b$  as follows:

$$A_w = \{ \langle \max(t_{ij} | i = 1, 2, \dots, m) | j \in J_- \rangle, \langle \min(t_{ij} | i = 1, 2, \dots, m) | j \in J_+ \rangle \} \equiv \{ t_{wj} | j = 1, 2, \dots, n \} \quad (8)$$

$$A_b = \{ \langle \min(t_{ij} | i = 1, 2, \dots, m) | j \in J_- \rangle, \langle \max(t_{ij} | i = 1, 2, \dots, m) | j \in J_+ \rangle \} \equiv \{ t_{bj} | j = 1, 2, \dots, n \} \quad (9)$$

Where:

$J_+ = \{j = 1, 2, \dots, n | j = \text{Associates with the decision criteria having a positive impact}\}$

$J_- = \{j = 1, 2, \dots, n | j = \text{Associates with the decision criteria having a negative impact}\}$

**Step 5:** Calculate the separation measures for each alternatives from the best ideal solution  $d_b$  and the worst ideal solution  $d_w$  as follows:

$$d_{ib} = \sqrt{\sum_{j=1}^n (t_{ij} - t_{bj})^2}, i = 1, 2, \dots, m \quad (10)$$

$$d_{iw} = \sqrt{\sum_{j=1}^n (t_{ij} - t_{wj})^2}, i = 1, 2, \dots, m \quad (11)$$

**Step 6:** Calculate the relative closeness coefficient to the ideal solution for each alternative as follows:

$$s_{iw} = \frac{d_{iw}}{d_{ib} + d_{iw}}, i = 1, 2, \dots, m \quad (12)$$

**Step 7:** Rank the decision alternatives according to the relative closeness coefficient  $S_{iw}$  in descending order. The

best alternative gives the highest  $S_{iw}$  among the alternatives.  $S_{iw} = 1$  if and only if the decision alternative solution has the best condition whereas  $S_{iw} = 0$  if and only if the decision alternative solution has the worst condition.

**RESULTS AND DISCUSSION**

Figure 2 shows the priorities or weights of all decision criteria in the selection of fast food restaurants. Based on Fig. 2, the priority of decision criteria in the selection of fast food restaurant is the environment (0.4114), customer service (0.1405), efficiency (0.1398), location (0.1234), price (0.1042) and finally flexibility (0.0806). The results show that environment is the most influential criterion in the selection of fast food restaurant. The consistency ratio is 0.0059 which is well below 0.1000. This implies that the pairwise comparison matrix does not exhibit any significant inconsistency and therefore, the result is reliable.

The distance of all decision alternatives from the best ideal solution ( $d_b$ ) as well as from the worst ideal solution ( $d_w$ ) are determined by using the Eq. 10 and 11, respectively. The distance of all decision alternatives from the best ideal solution ( $d_b$ ) for McDonald, KFC, Pizza Hut, Domino Pizza and Wing Zone are 0.0000, 0.2137, 0.2352, 0.2906 and 0.2600, respectively. On the other hand, the distance of all decision alternatives from the worst ideal solution ( $d_w$ ) for McDonald, KFC, Pizza Hut, Domino Pizza and Wing Zone are 0.2985, 0.0909, 0.0721, 0.0168 and 0.0479, respectively. Figure 3 and Table 4 present the relative closeness coefficient to the ideal solution and the ranking of fast food restaurant, respectively.

As shown in Fig. 3 and Table 4, McDonald gives the maximum value of relative closeness coefficient to the

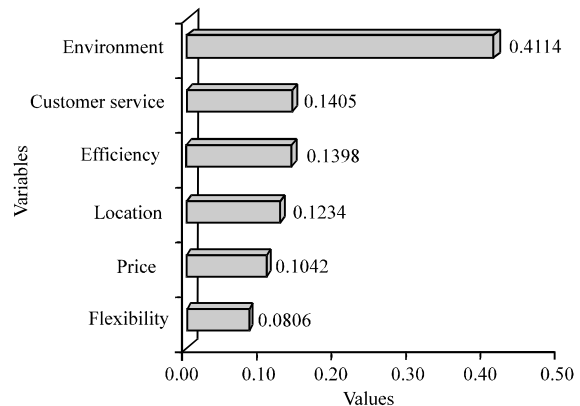


Fig. 2: Priority of decision criteria in the selection of fast food restaurants

Table 4: Ranking of fast food restaurant

Fast food restaurant	Relative closeness coefficient	Rank
McDonald	1.0000	1
KFC	0.2985	2
Pizza Hut	0.2347	3
Domino Pizza	0.0546	5
Wing Zone	0.1556	4

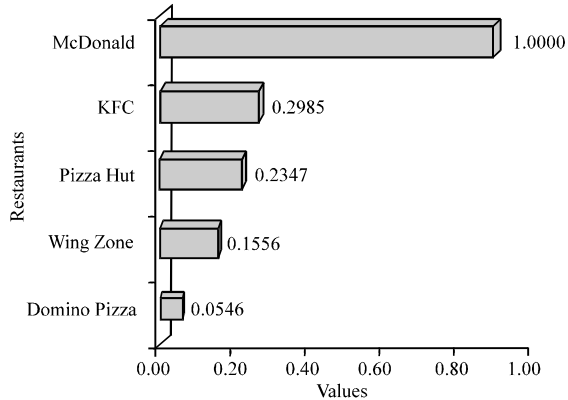


Fig. 3: Relative closeness coefficient to the ideal solution of fast food restaurant

deal solution ( $s_w = 1.0000$ ). This implies that McDonald is the most preferred fast food restaurant with respect to all decision criteria such as price, customer service, environment, efficiency, flexibility and location. The relative closeness coefficient to the ideal solution,  $s_w$  for KFC, Pizza Hut, Domino Pizza and Wing Zone are 0.2985, 0.2347, 0.0546 and 0.1556, respectively. This implies that the preference of the fast food restaurants is followed by KFC, Pizza Hut, Wing Zone and finally Domino Pizza.

**CONCLUSION**

McDonald is the most preferred fast food restaurant followed by KFC, Pizza Hut, Wing Zone and Domino Pizza in Malaysia with respect to price, customer service, environment, efficiency, flexibility as well as location. Environment is ranked as the most influential decision criterion in this study. The priority of the decision criteria is followed by customer service, efficiency, location, price and finally flexibility.

The significance of this study is to identify the most preferred fast food restaurant in Malaysia and the most important criteria in decision making process. AHP-TOPSIS Model can be applied as a business model for the less favourable fast food restaurants such as Wing Zone and Domino Pizza to identify their potential improvements based on the most influential criteria in this study.

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