American Journal of Information Science and Computer Engineering
Vol. 2, No. 3, 2016, pp. 15-21
http://www.aiscience.org/journal/ajisce
ISSN: 2381-7488 (Print); ISSN: 2381-7496 (Online)

An Empirical Study on the Selection of Fast Food Restaurants Among the Undergraduates with AHP Model

Lam Weng Siew[1, 2, *], Chen Jia Wai[1], Lam Weng Hoe[1, 2]

[1]Department of Physical and Mathematical Science, Faculty of Science, UniversitiTunku Abdul Rahman, Kampar Campus, Kampar, Perak, Malaysia
[2]Centre for Mathematical Sciences, Centre for Business and Management, UniversitiTunku Abdul Rahman, Kampar Campus, Kampar, Perak, Malaysia

Abstract

Fast food is the food that can be prepared in a fast and standardize way as well as can be distributed quickly. The blooming of fast food restaurants have become the favourite choice among the undergraduates in Malaysia. They tend to choose fast food as alternatives besides traditional food in Malaysia due to the convenience. The objective of this paper is to determine the priority of decision criteria in the selection of fast food restaurants among the undergraduates in Universiti Tunku Abdul Rahman, Malaysia with Analytic Hierarchy Process (AHP) Model. The decision criteria identified in this study are price, customer service, environment, flexibility, efficiency, location and cleanliness. Besides that, this paper also aims to determine the most preferred fast food restaurant among McDonald, Kentucky Fried Chicken (KFC), Pizza Hut, Domino Pizza and Wing Zone with AHP Model. 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 among the undergraduates. Price, customer service and cleanliness are ranked as the top three influential factors by the undergraduates in this study. The significant of this paper is to determine the most preferred fast food restaurantas well as the most influential decision criteria in the selection of fast food restaurants by the undergraduates in Malaysia with AHP model.

Keywords

Fast Food Restaurants, Multi-Criteria Decision Making, Analytic Hierarchy Process, Priority, Undergraduates

Received: June 6, 2016 / Accepted: June 16, 2016 / Published online: July 15, 2016

1. Introduction

A fast food restaurant is defined as a restaurant that can supply the food rapidly and requires minimum services. Normally this type of restaurant is the franchise restaurant chain. It was built up with the walk up counter or even the drive-thru window. Fast food implies that the food which can be served in the shortest time [1]. The fast food franchises have grown rapidly in Malaysia such as Kentucky Fried Chicken (KFC), McDonald, Pizza Hut, Domino Pizza and so on. The blooming of fast food restaurants have become the favourite choice among the undergraduates in Malaysia. They tend to choose fast food as alternatives besides traditional food in Malaysia due to the convenience. Since there are variety of fast food restaurants available, they have to set preference on the selection of fast food restaurants based on multiple criteria or factors. The evolution and marketing of fast food have influenced the young people consumption habit [2]. Besides that, other factors such as price, customer service, environment and efficiency have been identified as the decision criteria or factors in the selection of fast food restaurant.

* Corresponding author
E-mail address: lamws@utar.edu.my (L. W. Siew), jiawai_chen@hotmail.com (C. J. Wai), whlam@utar.edu.my (L. W. Hoe)

In order to make decision scientifically, Analytic Hierarchy Process (AHP) model is one of the preferable methods to solve this multi-criteria decision making (MCDM) problem. AHP was first introduced by Saaty[3]. It is designed to solve MCDM problem based on the priority ranked to the decision criteria and alternatives. The objective of this paper is to determine the priority of decision criteria in the selection of fast food restaurant among the undergraduates in Universiti Tunku Abdul Rahman, Malaysia with Analytic Hierarchy Process (AHP) Model. The decision criteria identified in this study are price, customer service, environment, flexibility, efficiency, location and cleanliness. Besides that, this paper also aims to determine the most preferred fast food restaurant among McDonald, Kentucky Fried Chicken (KFC), Pizza Hut, Domino Pizza and Wing Zone with AHP Model. The rest of the paper is organized as follows. The next section describes the literature review. Section 3 discusses about the materials and methods used in this study. Section 4 presents the empirical results of this study and section 5 concludes the paper.

2. Literature Review

Min and Min [4] investigated the differences in the perceived service quality between USA and Korea. They collected the data from six different fast food restaurants in Southeastern and Midwestern US and five different fast food restaurants in Seoul, South Korea. The results show that cleanliness and employee courtesy are the top two factors in the selection of fast food restaurants for Korean customers. However, price and location are the top two factors in the selection of fast food restaurants for US customers.

Chow and Luk [5] studied the service quality of fast food restaurant with Analytic Hierarchy Process (AHP) model. A survey was conducted over a three week periods and seventy two respondents were selected. Empathy, tangibles and assurance were ranked as the top three service quality in their study. Untaru and Ispas [6] conducted a study on assessing preference of young people between the local fast food restaurants and international fast food restaurants. Price, cleanliness and service are part of the decision criteria that considered by the young people in the selection of fast food restaurants.

Kavitha *et al.* [7] concluded that intrinsic factors like health, sensory appeal and price play a significant role in affecting food preference among generation *Y*. Intan Maizura *et al.* [8] has done a research on investigating the impact of service quality and food quality towards customer satisfaction. Intan Maizura *et al.* [8] identified that customers' loyalty is affected by service quality and customer satisfaction. According to Irza *et al.* [9], price perception and physical environment affect the customers' loyalty in the selection of fast food restaurant.

AHP model has been widely used in other fields as well. Rimantho *et al.* [10] appraised the ranking of waste electronic products and determined proper management for these waste with AHP model. Lam *et al.* [11] studied the job selection among the undergraduates by using AHP model. Jaberidoost *et al.* [12] used AHP model to assess the risk in pharmaceutical supply chain in Iran. Khan *et al.* [13] applied AHP model also to rank the buying factors of private health insurance from the low income group. Lam *et al*. [14] studied the preference in the selection of mobile network operators in Malaysia based on multiple criteria using AHP model. In Indian, AHP is applied to determine the ranking of most appropriate biomass energy sources to produce renewable energy [15]. Lastly, Cancela *et al.* [16] studied the significant factors for designing and assessing a telehealth system for Parkinson's disease. AHP model has been used to solve multi-criteria decision making problem in various fields.

Based on the past studies, AHP model has been applied in the selection of fast food restaurants in different countries. However, AHP model has not been studied actively in Malaysia yet. Therefore, this paper aims to fill the research gap by studying the selection of fast food restaurants among the undergraduates in Malaysia with AHP model.

3. Materials and Methods

3.1. Data

In this study, McDonald, Kentucky Fried Chicken (KFC), Pizza Hut, Domino Pizza and Wing Zone are selected as the decision alternatives. The decision criteria include price, customer service, environment, flexibility, efficiency, location and cleanliness. AHP model is used to determine the priorities of decision alternatives and criteria among the undergraduates. In this study, 140 undergraduates from Universiti Tunku Abdul Rahman, Kampar Campus in Malaysia are selected as the target respondents.

3.2. Analytic Hierarchy Process

AHP model is designed to solve multi-criteria decision making problem by decomposition of the problem into a hierarchy. The hierarchy consists of three levels which are top, middle and bottom level. Top level is the main objective, middle level is the decision criteria whereas the bottom level contains decision alternatives. Figure 1 presents the general hierarchy structure in AHP model.

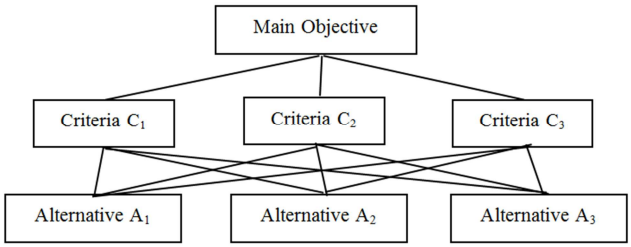

Figure 1. General Hierarchy Structure in AHP model.

Data analysis in AHP model can be divided into five steps as shown below [17].

Step 1: Identify the objective, decision criteria and decision alternatives in building the hierarchy structure.

Table 1 shows the three levels of hierarchy in this research which consists of the main objective, decision criteria and decision alternatives for the selection of fast food restaurants.

Table 1. Hierarchy Structure for the Selection of Fast Food Restaurants.

Top Level	Selection of Fast Food Restaurant
(Main Objective)	
Middle Level	1. Price (C_1)
(Decision Criteria)	2. Customer Service (C_2)
	3. Environment (C_3)
	4. Flexibility (C_4)
	5. Efficiency (C_5)
	6. Location (C_6)
	7. Cleanliness (C_7)
Bottom Level	1. McDonald (A_1)
(Decision	2. KFC (A_2)
Alternative)	3. Pizza Hut (A_3)
	4. Domino Pizza (A_4)
	5. Wing Zone (A_5)

Step 2: Each element in the second and third level of the hierarchy structure is compared in pairwise to obtain its relative importance to the problem. Saaty [3] has introduced a ratio scale for pairwise comparison as shown in Table 2.

Table 2. Ratio Scale used for pairwise comparison.

Scale	Definition
1	A and B are of equal importance
3	A has a slightly higher importance than B
5	A has a strong importance than B
7	A has a very strong importance than B
9	A has a absolute importance than B
2,4,6,8	Intermediate values

If there are n decision criteria or decision alternatives, then the number of pairwise comparisons will be formulated as below.

$$(0.5)n(n-1) \tag{1}$$

A pairwise comparison matrix **C** for n decision criteria is shown below.

$$\mathrm{C} = \begin{array}{c} \\ C_1 \\ C_2 \\ C_3 \\ \dots \\ C_n \end{array} \begin{array}{c} \begin{array}{ccccc} C_1 & C_2 & C_3 & \dots & C_n \end{array} \\ \begin{bmatrix} 1 & a_{12} & a_{13} & \dots & a_{1n} \\ 1/a_{12} & 1 & a_{23} & \dots & a_{2n} \\ 1/a_{13} & 1/a_{23} & 1 & \dots & a_{3n} \\ \dots & \dots & \dots & \dots & \dots \\ 1/a_{1n} & 1/a_{2n} & 1/a_{3n} & \dots & 1 \end{bmatrix} \end{array} \tag{2}$$

A pairwise comparison matrix B for m decision alternatives, compared in terms of one decision criterion is shown below.

$$\mathrm{B} = \begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \\ \dots \\ A_m \end{array} \begin{array}{c} \begin{array}{ccccc} A_1 & A_2 & A_3 & \dots & A_m \end{array} \\ \begin{bmatrix} 1 & b_{12} & b_{13} & \dots & b_{1m} \\ 1/b_{12} & 1 & b_{23} & \dots & b_{2m} \\ 1/b_{13} & 1/b_{23} & 1 & \dots & b_{3m} \\ \dots & \dots & \dots & \dots & \dots \\ 1/b_{1m} & 1/b_{2m} & 1/b_{3m} & \dots & 1 \end{bmatrix} \end{array} \tag{3}$$

In this study, the pairwise comparison matrix C obtained for seven decision criteria is shown below.

$$\mathrm{C} = \begin{bmatrix} 1.00 & 2.18 & 1.77 & 2.36 & 1.61 & 2.18 & 1.05 \\ 0.46 & 1.00 & 2.75 & 2.97 & 2.31 & 2.62 & 1.13 \\ 0.57 & 0.36 & 1.00 & 2.53 & 1.53 & 1.78 & 0.89 \\ 0.42 & 0.34 & 0.40 & 1.00 & 0.94 & 1.19 & 0.60 \\ 0.62 & 0.43 & 0.66 & 1.06 & 1.00 & 2.27 & 0.92 \\ 0.46 & 0.38 & 0.56 & 0.84 & 0.44 & 1.00 & 0.70 \\ 0.96 & 0.88 & 1.12 & 1.66 & 1.08 & 1.43 & 1.00 \end{bmatrix} \tag{4}$$

The pairwise comparison matrix $\mathrm{B_{Ci}}$ (i=1,2,3,..7) for five decision alternatives, compared in terms of each decision criterion is shown as follows.

Price (C_1):

$$\mathrm{B_{C1}} = \begin{bmatrix} 1.00 & 3.68 & 4.04 & 3.61 & 3.65 \\ 0.27 & 1.00 & 3.09 & 2.82 & 2.99 \\ 0.25 & 0.32 & 1.00 & 1.64 & 1.99 \\ 0.28 & 0.35 & 0.61 & 1.00 & 2.28 \\ 0.27 & 0.33 & 0.50 & 0.44 & 1.00 \end{bmatrix} \tag{5}$$

Customer Service (C_2):

$$\mathrm{B_{C2}} = \begin{bmatrix} 1.00 & 3.33 & 2.66 & 2.43 & 1.78 \\ 0.30 & 1.00 & 1.67 & 1.47 & 1.19 \\ 0.38 & 0.60 & 1.00 & 1.65 & 1.54 \\ 0.41 & 0.68 & 0.61 & 1.00 & 1.45 \\ 0.56 & 0.84 & 0.65 & 0.69 & 1.00 \end{bmatrix} \tag{6}$$

Environment (C_3):

$$B_{C3} = \begin{bmatrix} 1.00 & 3.06 & 2.12 & 2.84 & 1.20 \\ 0.33 & 1.00 & 1.44 & 1.65 & 0.88 \\ 0.47 & 0.70 & 1.00 & 2.09 & 1.17 \\ 0.35 & 0.61 & 0.48 & 1.00 & 1.01 \\ 0.83 & 1.14 & 0.85 & 0.99 & 1.00 \end{bmatrix} \quad (7)$$

Flexibility (C_4):

$$B_{C4} = \begin{bmatrix} 1.00 & 5.36 & 4.93 & 4.93 & 4.61 \\ 0.19 & 1.00 & 2.02 & 1.86 & 1.49 \\ 0.20 & 0.49 & 1.00 & 1.64 & 1.27 \\ 0.20 & 0.54 & 0.61 & 1.00 & 1.24 \\ 0.22 & 0.67 & 0.79 & 0.81 & 1.00 \end{bmatrix} \quad (8)$$

Efficiency (C_5):

$$B_{C5} = \begin{bmatrix} 1.00 & 3.59 & 3.49 & 2.99 & 2.52 \\ 0.28 & 1.00 & 2.44 & 2.15 & 1.88 \\ 0.29 & 0.41 & 1.00 & 1.57 & 1.37 \\ 0.33 & 0.47 & 0.64 & 1.00 & 1.18 \\ 0.40 & 0.53 & 0.73 & 0.85 & 1.00 \end{bmatrix} \quad (9)$$

Location (C_6):

$$B_{C6} = \begin{bmatrix} 1.00 & 5.04 & 5.24 & 3.08 & 2.33 \\ 0.20 & 1.00 & 2.39 & 1.04 & 1.05 \\ 0.19 & 0.42 & 1.00 & 0.77 & 0.75 \\ 0.32 & 0.96 & 1.29 & 1.00 & 1.19 \\ 0.43 & 0.96 & 1.33 & 0.84 & 1.00 \end{bmatrix} \quad (10)$$

Cleanliness (C_7):

$$B_{C7} = \begin{bmatrix} 1.00 & 3.16 & 2.07 & 1.64 & 1.23 \\ 0.32 & 1.00 & 1.11 & 1.06 & 0.91 \\ 0.48 & 0.90 & 1.00 & 1.58 & 1.04 \\ 0.61 & 0.95 & 0.63 & 1.00 & 1.05 \\ 0.81 & 1.10 & 0.96 & 0.95 & 1.00 \end{bmatrix} \quad (11)$$

Step 3: Weights for each decision criterion and decision alternatives are obtained through the normalization method. First of all, sum for each column in the matrices is calculated and all elements in a column are divided by the column's sum. Eight new normalized matrix are formed. The average for each row in the newly formed matrices represents the priorities or weight for the decision criteria and decision alternative respectively.

Step 4: The overall weights for the decision alternatives in matrix **F** is computed as below.

$$\mathbf{F} = \mathbf{Q} \times \mathbf{w}^{\mathbf{T}} \quad (12)$$

Highest weight in matrix **F** indicates that the particular decision alternative gives the highest ranking.

Step 5: In order to check for consistency in pairwise comparison matrix, Saaty [3] has introduced the consistency ratio (*CR*) which is defined in terms of consistency index (*CI*) and random index (*RI*) with the formula as shown below.

$$CR = \frac{CI}{RI} \quad (13)$$

CI is defined as below.

$$CI = \frac{\lambda_{\max} - n}{n-1} \quad (14)$$

λ_{max} is the maximum eigenvalue,

n is total number of decision criteria.

Table 3 shows the random index (*RI*) with respect to the number of decision criteria.

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

If $CR \leq 0.10$, the level of inconsistency in the pairwise comparison matrix is satisfactory and therefore, the result is acceptable.

4. Empirical Results

Figure 2 shows the weights or priority of all decision criteria in the selection of fast food restaurants among the undergraduates based on matrix **C** in (4).

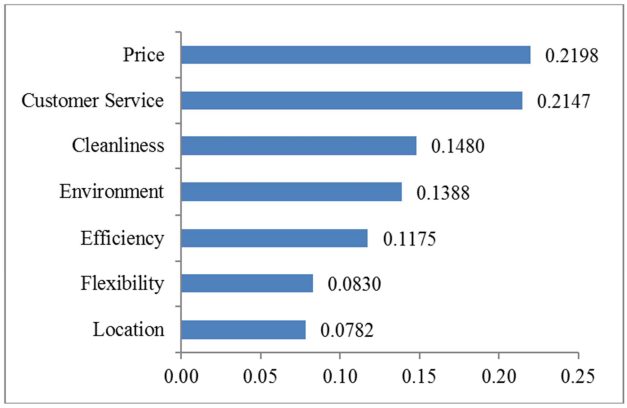

Figure 2. Priority of Decision Criteria in the Selection of Fast Food Restaurants.

As shown in Figure 2, the priority of decision criteria in the selection of fast food restaurants is the price (0.2198) followed by customer service (0.2147), cleanliness (0.1480), environment (0.1388), efficiency (0.1175), flexibility (0.0830) and finally location (0.0782). Price and customer service are the most influential criteria in the selection of fast food restaurants among the undergraduates.

Figure 3 to Figure 9 display the preference of fast food restaurants based on each decision criterion from (5) to (11).

Price (C_1):

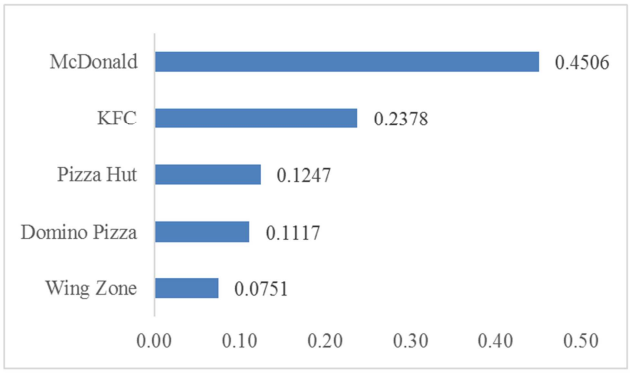

Figure 3. Preference of Fast Food Restaurants Based on Price.

Customer Service (C_2):

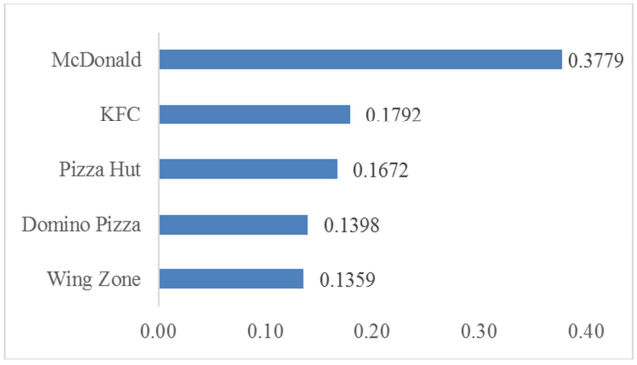

Figure 4. Preference of Fast Food Restaurants Based on Customer Service.

Environment (C_3):

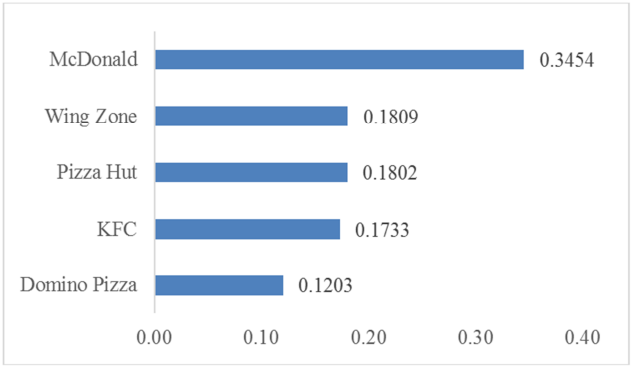

Figure 5. Preference of Fast Food Restaurants Based on Environment.

Flexibility (C_4):

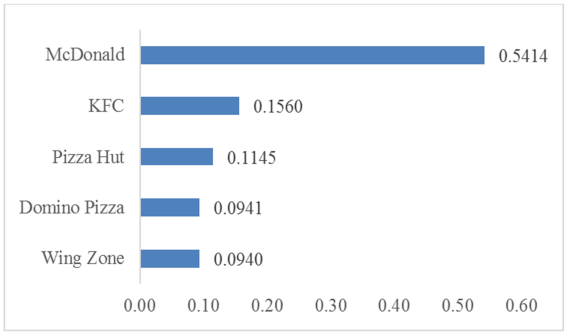

Figure 6. Preference of Fast Food Restaurants Based on Flexibility.

Efficiency (C_5):

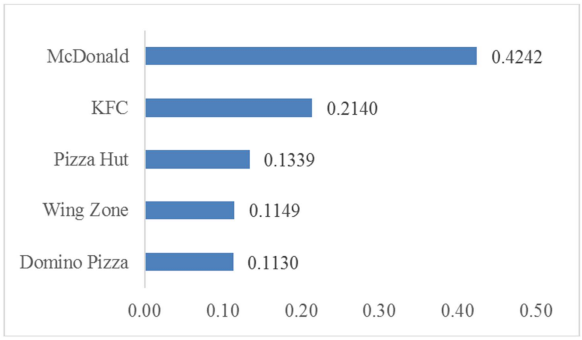

Figure 7. Preference of Fast Food Restaurants Based on Efficiency.

Location (C_6):

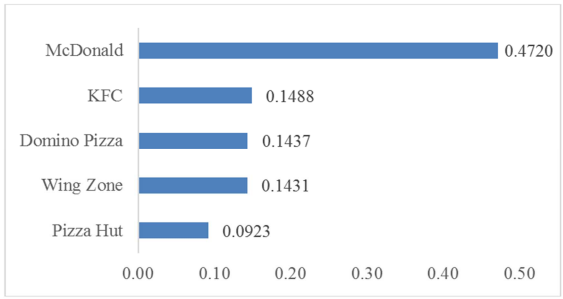

Figure 8. Preference of Fast Food Restaurants Based on Location.

Cleanliness (C_7):

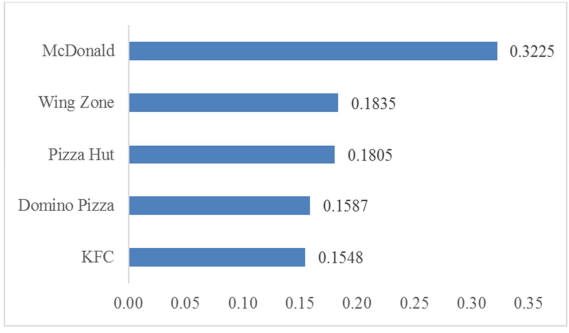

Figure 9. Preference of Fast Food Restaurants Based on Cleanliness.

As shown from Figure 3 to Figure 9, McDonald has the top ranking for all decision criteria. This implies that McDonald is the most preferred fast food restaurant among the undergraduates in UTAR Kampar, Malaysia in terms of price, customer service, environment, flexibility, efficiency, location as well as cleanliness. After McDonald, KFC excels other fast food restaurants in terms of all decision criteria except environment and cleanliness. Wing Zone and Domino Pizza are ranked at the lowest for most of the decision criteria. Wing Zone is ranked at the lowest in terms of price, customer service and flexibility. Domino Pizza is ranked at the lowest in terms of environment and efficiency.

Figure 10 presents the overall weights or priority in the selection of fast food restaurants in this study.

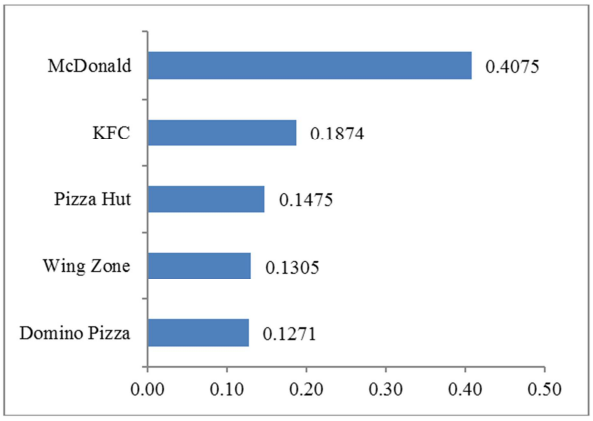

Figure 10. Overall Weights in the Selection of Fast Food Restaurants.

Based on Figure 10, the results show that McDonald (0.4075) is the most preferred fast food restaurant among the undergraduates with respect to all decision criteria which are price, customer service, environment, flexibility, efficiency, location and cleanliness. The preference of the fast food restaurants is followed by KFC (0.1874), Pizza Hut (0.1475), Wing Zone (0.1305) and finally Domino Pizza (0.1271). In this study, the overall consistency ratio is 0.0348 which is well below 0.10. This implies that the pairwise comparison matrix does not show any inconsistencies problem. Therefore, the results obtained in this study with AHP model are acceptable and reliable.

5. Conclusion

This paper aims to determine the priority of decision criteria in the selection of fast food restaurants among the undergraduates in Malaysia with AHP Model. The decision criteria identified in this study are price, customer service, environment, flexibility, efficiency, location and cleanliness. Besides that, this paper also aims to determine the most preferred fast food restaurant among McDonald, KFC, Pizza Hut, Domino Pizza and Wing Zone with AHP Model. The results of this study show that McDonald is the most preferred restaurant followed by KFC, Pizza Hut, Wing Zone and Domino Pizza among the undergraduates. Price, customer service and cleanliness are ranked as the top three influential decision criteria by the undergraduates in this study. The significance of this paper is to determine the most preferred fast food restaurantas well as the most influential decision criteria in the selection of fast food restaurants by the undergraduates in Malaysia with AHP model. Furthermore, this study also helps other less favourable fast food restaurants such as Wing Zone and Domino Pizza to identify the potential improvements based on the most influential decision criteria.

References

[1] Intan, M. A. R., Muhammad, F. S. A., Bibi, N. M. Y. and Mohd, S. S. (2014). Impact of service and food quality on customer satisfaction among generation Y for the fast food restaurant in Malaysia. *Journal of Social Sciences Research*, 5(2): 784-793.

[2] Untaru, E. and Ispas, A. (2014). A different approach of competitive importance-performance analysis: the case of young Romanians' preference for a local fast-food. *StudiaUniversitatisBabeş–BolyaiNegotia*, 59(4): 5-30.

[3] Saaty, T. L. (1980). *The Analytic Hierarchy Process*. New York, McGraw-Hill.

[4] Min, H. and Min, H. (2011). Cross-cultural competitive benchmarking of fast-food restaurant services. *Benchmarking: An International Journal*, 20(2): 212-232.

[5] Chow, C. C. and Luk, P. (2005). A strategic service quality approach using Analytic Hierarchy Process. *Managing Service Quality*, 15(3): 278-289.

[6] Untaru, E. and Ispas, A. (2014). A different approach of competitive importance-performance analysis: the case of young Romanian's preference for a local fast-food. *Studia UBB Negotia*,59(4): 5-30.

[7] Kavitha, H., Souji, G. and Prabhu, R. (2011). A study on factors influencing generation Y's food preferences with special reference to Kuala Lumpur, Malaysia. *Zenith International Journal Of Business Economics & Management Research*,1(3): 1-14.

[8] Intan, M. A. R., Mohd, J. A. R., Bibi, N. M. Y. and Mohd, S. S. (2015). The impact of service quality and customer satisfaction on customer's loyalty: evidence from fast food restaurant of Malaysia. *International Journal Of Information, Business And Management*, 7(4): 201-236.

[9] Irza, H. A. S., Muhammad, J. A. R., Nor Irwani, A. R. and Muhammad, F. S. A. (2015). The roles of price perception and physical environment in determining customer loyalty: Evidence from fast food restaurant of Malaysia. International Journal of Development Research, 5(5): 4366-4370.

[10] Rimantho, D., Cahyadi, B. and Dermawan, D. (2015). Application Analytic Hierarchy Process (AHP): A case study of-waste management in Surabaya, Indonesia. *Proceeding 8th International Seminar On Industrial Engineering And Management*, 8: 1-10.

[11] Lam, W. S., Lee, W. K. and Lam, W. H. (2015). Multi-criteria decision making in job selection problem using Analytic Hierarchy Process model. *Mathematics and Statistics Journal*, 1(2): 3-7.

[12] Jaberidoost, M., Olfat, L., Hosseini, A., Kebriaeezadeh, A., Abdollahi, M., Alaeddini, M. and Dinarvand1, R. (2015). Pharmaceutical supply chain risk assessment in Iran using Analytic Hierarchy Process (AHP) andSimple Additive Weighting (SAW) methods. *Journal Of Pharmaceutical Policy And Practice*, 8(9): 1-10.

[13] Khan, M., Bharathi. S. V. and Londhe, B. R. (2015). Ranking thecritical buying factors of private healthinsurance using Analytic Hierarchy Process. *Indian Journal Of Science And Technology*, 8(6): 35-42.

[14] Lam, W. S., Leong, W. B. and Lam, W. H. (2015). Selection of mobile network operator based on multi-criteria decision making model using Analytic Hierarchy Process. *Mathematics and Statistics Journal*, 1(1): 12-18.

[15] Yadav, S., Srivatava, A. K. and Singh, R. S. (2015). Selection and ranking of multi-criteria for the prioritization of most appropriate biomass energy sources for the production of renewable energy in Indianperspective using Analytic Hierarchy Process. *International Journal Of Engineering Technology Science And Research*, 2: 89-98.

[16] Cancela, J., Fico, G. and Waldmeyer, M. T. A. (2015). Using the Analytic Hierarchy Process (AHP) to understand the most important factors to design and evaluate a telehealth system for parkinson's disease. *BMC Medical Informatics And Decision Making*,15(3): 1-11.

[17] Winston, W. L. (2004). *Operations Research and Algorithms*. Belmont, Brooks/Cole.