An Empirical Study on the Preference of Supermarkets with Analytic Hierarchy Process Model

Lam Weng Siew¹,²,³*, Ranjeet Singh a/l Bishan Singh¹,², Lam Weng Hoe¹,²,³ and Liew Kah Fai¹,³

¹Department of Physical and Mathematical Science, Faculty of Science, UniversitiTunku Abdul Rahman, Kampar Campus, JalanUniversiti, Bandar Barat, 31900 Kampar, Perak, Malaysia
²Centre for Business and Management, UniversitiTunku Abdul Rahman, Kampar Campus, JalanUniversiti, Bandar Barat, 31900 Kampar, Perak, Malaysia
³Centre for Mathematical Sciences, UniversitiTunku Abdul Rahman, Kampar Campus, JalanUniversiti, Bandar Barat, 31900 Kampar, Perak, Malaysia

* E-mail: lamws@utar.edu.my

Abstract. Large-scale retailers are very important to the consumers in this fast-paced world. Selection of desirable market to purchase products and services becomes major concern among consumers in their daily life due to vast choices available. Therefore, the objective of this paper is to determine the most preferred supermarket among AEON, Jaya Grocer, Tesco, Giant and Econsave by the undergraduate students in Malaysia with Analytic Hierarchy Process (AHP) model. Besides that, this study also aims to determine the priority of decision criteria in the selection of supermarkets among the undergraduate students with AHP model. The decision criteria employed in this study are product quality, competitive price, cleanliness, product variety, location, good price labelling, fast checkout and employee courtesy. The results of this study show that AEON is the most preferred supermarket followed by Jaya Grocer, Tesco, Econsave and Giant among the students based on AHP model. Product quality, cleanliness and competitive price are ranked as the top three influential factors in this study. This study is significant because it helps to determine the most preferred supermarket as well as the most influential decision criteria in the preference of supermarkets among the undergraduate students with AHP model.

Introduction

Large-scale retailers are available almost in every corner of the world nowadays which includes hypermarket, supermarket, superstore, department store, discount store and shopping centre [1-3]. Selection of desirable market to purchase products and services becomes major concern among consumers in their daily life due to vast choices available. In order to stimulate the buying trend and encourage customers to visit supermarkets, modern retailers in Malaysia have organized sales during festive seasons with attractive discounts rate. Store attribute such as low price, convenience, wide variety of merchandise, good quality and services are important factors that contribute to consumers’ image formation and affect their store choice decision [4-8]. Therefore, the modern retailers have to be conscious on the need of customers.

In this study, Analytic Hierarchy Process (AHP) model is applied to study the attributes that associates with the students’ tendency of visiting or shopping at certain supermarkets. In Malaysia, there are several major supermarkets in the retail industry such as AEON, Jaya Grocer, Tesco, Giant and Econsave. Most of the supermarkets provide similar characteristic in the aspect of product quality, competitive price, cleanliness, product variety, suitable location, good price labelling, fast checkout
and employee courtesy. Furthermore, most of the modern retail businesses have stated that consumers’ preferences towards supermarkets play a vital role in the continuation of businesses in the industry as well as improving competitive advantage among the competitors. AHP model has been used in decision making problems such as maintenance selection problem [9], selection of fast food restaurant [10], supplier selection [11], job selection [12], selection of mobile network operators [13] and so forth.

This study aims to identify the key factors that influence the students’ choice of desirable supermarket. Besides that, the most preferred supermarket will be determined based on the chosen criteria at the end of this study. This paper is organized as follows. The next section describes the data and methodology and section 3 presents the empirical results of this study. Section 4 concludes the paper.

Data and Methodology

In this study, AEON, Jaya Grocer, Tesco, Giant and Econsave are identified as decision alternatives. The decision criteria such as product quality, competitive price, cleanliness, product variety, location, good price labelling, fast checkout and employee courtesy are used in the supermarkets selection[14]. AHP model is used to develop the hierarchy structure to determine the priorities of decision criteria as well as decision alternatives among the undergraduate students from UniversitiTunku Abdul Rahman (UTAR), Malaysia.

AHP model can be utilized to tackle multi-criteria decision making problem by decomposition of the problem into a hierarchy. AHP model was developed by Saaty [15] which specifically implemented in situations whereby the decision making process requires to take into consideration on multiple objectives that contradict with each other. This method assigns factors and alternatives involved into a hierarchy structure which provides the decision makers an overview on the relationships among identified factors and decision criteria. AHP model is driven by relative measurement that compares the relative importance among decision criteria as well as the subjects under study with respect to each criterion in pairwise form [16, 17]. The five steps of the AHP model are presented as follows:

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

The three levels of hierarchy which consists of the main objective, decision alternatives and decision criteria for the supermarkets selection is presented in Table 1.

| Top Level (Main Objective) | Selection of Supermarket |
|----------------------------|--------------------------|
|                            | 1. Product Quality (C_1) |
|                            | 2. Competitive Price (C_2)|
|                            | 3. Cleanliness (C_3)     |
|                            | 4. Product Variety (C_4) |
|                            | 5. Location (C_5)        |
|                            | 6. Good Price Labelling (C_6) |
|                            | 7. Fast Checkout (C_7)   |
|                            | 8. Employee Courtesy (C_8) |

| Middle Level (Decision Criteria) |                           |
|----------------------------------|---------------------------|
| 1. AEON (A_1)                   |
| 2. Jaya Grocer (A_2)            |
| 3. Tesco (A_3)                  |
| 4. Giant (A_4)                  |
| 5. Econsave (A_5)               |

| Bottom Level (Decision Alternative) |                           |
|------------------------------------|---------------------------|
| 1. Product Quality (C_1)           |
| 2. Competitive Price (C_2)         |
| 3. Cleanliness (C_3)               |
| 4. Product Variety (C_4)           |
| 5. Location (C_5)                  |
| 6. Good Price Labelling (C_6)      |
| 7. Fast Checkout (C_7)             |
| 8. Employee Courtesy (C_8)         |
Step 2: Compare all the elements in the second and third level of the hierarchy structure in pairwise order to get its relative importance to the problem. Saaty [15] proposed a relative measurement scale with range from 1-9 to represent the relative importance between two criteria or alternatives. The explanations regarding to the relative measurement are tabulated in Table 2.

| Scale | Interpretation |
|-------|----------------|
| 1     | Both objectives are indifferent or having equal importance. |
| 3     | One objective is moderately more important than another objective. |
| 5     | One objective is strongly preferred compared to another objective. |
| 7     | One objective is very strongly more significant than another objective. |
| 9     | One objective is extremely preferred than another objective. |
| 2, 4, 6, 8 | Intermediate importance between each of the scales above. |

The pairwise comparison matrix $C$ is computed for $n$ decision criteria is shown below.

$$C = \begin{bmatrix}
C_1 & C_2 & \ldots & C_n \\
1 & a_{12} & \ldots & a_{1n} \\
1/a_{12} & 1 & \ldots & a_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
1/a_{1n} & 1/a_{2n} & \ldots & 1
\end{bmatrix} \quad (1)$$

For each decision criterion, the pairwise comparison matrix $B$ is computed for $m$ decision alternatives is shown below.

$$B = \begin{bmatrix}
A_1 & A_2 & \ldots & A_m \\
1 & b_{12} & \ldots & b_{1m} \\
1/b_{12} & 1 & \ldots & b_{2m} \\
\vdots & \vdots & \ddots & \vdots \\
1/b_{1m} & 1/b_{2m} & \ldots & 1
\end{bmatrix} \quad (2)$$

Step 3: Obtain the weights of all the decision alternatives and decision criteria by using the normalization method. Firstly, the values in each column of the matrix are sum up and divide each element by its column’s sum [18]. This yields a new matrix called normalized pairwise comparison matrix. Compute the average of the elements in each row of the normalized matrix. The averages represent their relative priorities of the elements being compared.

Step 4: The matrix $F$ is computed and it represents the overall weights of the decision alternatives. The formula of the matrix $F$ is as shown below.

$$F = Q \times w^T \quad (3)$$

Matrix $Q$ shows the weights of decision alternatives for each decision criterion and matrix $w$ is the weights of decision criteria. Highest weight in matrix $F$ indicates that the particular decision alternative gives the highest ranking.
Step 5: Checking for consistency in pairwise comparison matrix by using consistency ratio (C.R.). The consistency ratio (C.R.) is expressed as the ratio of consistency index (C.I.) to random index (R.I.) [15] as shown below.

\[
C.R. = \frac{C.I.}{R.I.}
\]  

(4)

C.I. is defined as below.

\[
C.I. = \frac{\lambda_{max} - n}{n - 1}
\]  

(5)

\(\lambda_{max}\) is the maximum eigenvalue and \(n\) is total number of decision criteria.

The value of random index (R.I.) will be respect to the number of decision criteria [15]. The degree of consistency in pairwise comparison matrix is satisfactory if the value of C.R. is less than 0.10. Thus, the result generated can be accepted.

**Empirical Results**

The priority or weights of the decision criteria in the supermarkets selection among the undergraduate students is shown in Figure 1.

![Figure 1. The weights of decision criteria in the supermarkets selection.](image)

Based on Figure 1, the weights of decision criteria in the supermarkets selection among the undergraduate students is product quality (0.2698), cleanliness (0.1820), competitive price (0.1731), location (0.1211), product variety (0.0894), employee courtesy (0.0719), good price labelling (0.0561) and fast checkout (0.0366). Therefore, the top three influential decision criteria in the supermarkets selection among the undergraduate students are product quality, cleanliness and competitive price.

Figure 2 to Figure 9 present the preference of supermarkets based on each decision criterion.
Product Quality ($C_1$):

![Bar chart showing preference of supermarkets based on product quality.]

**Figure 2.** Preference of supermarkets based on product quality.

Competitive Price ($C_2$):

![Bar chart showing preference of supermarkets based on competitive price.]

**Figure 3.** Preference of supermarkets based on competitive price.

Cleanliness ($C_3$):

![Bar chart showing preference of supermarkets based on cleanliness.]

**Figure 4.** Preference of supermarkets based on cleanliness.
Product Variety ($C_4$):

![Chart showing preference of supermarkets based on product variety.](image)

Figure 5. Preference of supermarkets based on product variety.

Location ($C_5$):

![Chart showing preference of supermarkets based on location.](image)

Figure 6. Preference of supermarkets based on location.

Good Price Labelling ($C_6$):

![Chart showing preference of supermarkets based on good price labelling.](image)

Figure 7. Preference of supermarkets based on good price labelling.
Fast Checkout ($C_7$):

![Bar chart showing preference of supermarkets based on fast checkout.](image)

**Figure 8.** Preference of supermarkets based on fast checkout.

Employee Courtesy ($C_8$):

![Bar chart showing preference of supermarkets based on employee courtesy.](image)

**Figure 9.** Preference of supermarkets based on employee courtesy.

As shown from Figure 2 to Figure 9, AEON is the most favourable supermarket among the undergraduate students in terms of all decision criteria except for competitive price. Jaya Grocer obtains the second ranking in terms of product quality, cleanliness, product variety, good price labelling, fast checkout and employee courtesy. However, Jaya Grocer achieves the lowest ranking in terms of competitive price as compared to other supermarkets. On the other hand, Econsave is the most preferred supermarket in terms of competitive price. In this study, Tesco, Giant, and Econsave are ranked as third, fourth and fifth respectively for most of the decision criteria.

The overall weights in the preference of supermarkets among the undergraduate students with respect to all decision criteria are presented in Figure 10.
As shown in Figure 10, AEON (0.3575) is the most favourable supermarket among the undergraduate students based on all decision criteria such as product quality, competitive price, cleanliness, product variety, location, good price labelling, fast checkout and employee courtesy. The preference of the supermarkets is followed by Jaya Grocer (0.2284), Tesco (0.2085), Econsave (0.1124) and lastly Giant (0.0932). The degree of consistency of the data obtained is satisfactory since the consistency ratio is 0.0466 which is less than 0.1000. Therefore, it can be concluded that the ranking generated by the data yield meaningful results.

**Conclusion**

In this study, the top three important decision criteria in the supermarkets selection among the undergraduate students are product quality, cleanliness and competitive price. The priority of the decision criteria is followed by location, product variety, employee courtesy, good price labelling and lastly fast checkout. The results of this study indicate that AEON is the most favourable supermarket among the undergraduate students. The preference of the supermarkets is followed by Jaya Grocer, Tesco, Econsave and finally Giant. The significance of this paper is to identify the most important decision criteria in the supermarkets selection and also the most preferred supermarket among the undergraduate students. In addition, this study helps the less favourable supermarkets such as Econsave and Giant to identify the potential improvement based on the most influential decision criteria in this study.

**Acknowledgments**

The authors express gratitude to Universiti Tunku Abdul Rahman (UTAR) for the sponsorship.

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