209

Int. J Sup. Chain. Mgt   Vol. 7, No. 4, August, 2018

Evaluation on the Preference of Coffee Shop among the Undergraduate Students with Analytic Hierarchy Process Model

Lam Weng Siew[#*1], Mohd Abidin Bin Bakar[#**2], Lam Weng Hoe[#*3], Chen Jia Wai[#4] , Ma Hui Lee[#5]

[#] *Department of Physical and Mathematical Science, Faculty of Science, Universiti Tunku Abdul Rahman, Kampar Campus, Jalan Universiti, Bandar Barat, 31900 Kampar, Perak, Malaysia*

[*] *Centre for Mathematical Sciences, Universiti Tunku Abdul Rahman, Kampar Campus, Jalan Universiti, Bandar Barat, 31900 Kampar, Perak, Malaysia*

[**] *Centre for Business and Management, Universiti Tunku Abdul Rahman, Kampar Campus, Jalan Universiti, Bandar Barat, 31900 Kampar, Perak, Malaysia*

[1]lamws@utar.edu.my

[2]abidin@utar.edu.my

[3]whlam@utar.edu.my

[4]jiawai_chen@hotmail.com

[5]ligo28@1utar.my

Abstract— **Emergence of coffee shop in recent years has proven the demand of coffee shop in modern lifestyle. Nowadays, visitation to coffee shop has become a common trend for most of the undergraduate students for group discussion or chatting. This study aims to evaluate the preference of undergraduate students from Universiti Tunku Abdul Rahman in selecting the coffee shop based on multiple criteria. There are 19 respondents participating in this study who have visited all the 4 selected coffee shops which are Simple Coffee, Bean Café, Starbucks and Old Town White Coffee. An Analytic Hierarchy Process (AHP) model is proposed to determine the weight of criteria, priority of coffee shop selection in terms of each criterion and the overall performance of the coffee shop. The findings show that the most important criterion is cleanliness, followed by flavor, store atmosphere, sales promotion, speed of service, price and location. Starbucks is the most preferred coffee shop while the followings are Simple Coffee, Bean Café and Old Town White Coffee. The significance of this study is to propose a conceptual framework to identify the most preferred coffee shop and the most important criteria in coffee shop selection among the undergraduate students by using AHP model.**

Keywords— *Priority; Multi-Criteria Decision Making; Conceptual Framework; Coffee Shop*

1. Introduction

Coffee is one of the common yet popular beverages in the world. There are studies showing that coffee is able to enhance human brain function [1].

Besides that, it is proven that coffee helps to improve mental health and extending human's lifespan [2]-[4]. Coffee drinking is an important part of modern daily life [5]. Nowadays, many coffee lovers are willing to spend for good quality coffee. Coffee shops or coffee houses offer varieties of food and drinks such as latte, espresso, mocha, chocolate beverages, brewed tea, shaken tea, muffin, breads and cakes. The emerging of coffee shop has become one of the popular trends in food services [6]. Meanwhile, many researchers have started their investigation on coffee related business such as determining coffee shop location [7]-[8], selecting coffee growth location [9], ranking of coffee suppliers [10] and determining customers' preference on coffee selection [11]. University is one of the strategic location for operating coffee shops [7]-[8]. Therefore, the objective of this study is to evaluate the preference of coffee shop among the undergraduate students by using Analytic Hierarchy Process (AHP) model. The proposed conceptual framework is illustrated with a case study in Universiti Tunku Abdul Rahman (UTAR) Kampar Campus, Malaysia. In Kampar, Starbucks, Simple Coffee, Bean Café and Old Town White Coffee are the most frequent visited coffee shops by UTAR undergraduate students. The objective of this study is to determine the weight of criteria, priority of coffee shop selection in terms of each criterion and the overall performance of the coffee shop. AHP is a popular decision tool which helps to solve multiple criteria decision making (MCDM) problem. Based on the past studies, the decision criteria identified in this study are price [12],

210

Int. J Sup. Chain. Mgt   Vol. 7, No. 4, August, 2018

flavor [13], store atmosphere [13], sales promotion [14], location [15], speed of service and cleanliness [16].

From the past studies in food and beverage, AHP has been applied in a tea-based drink in Indonesia. Pangkey [17] investigated the bubble tea shop in Manado and found out that customers concern the flavor of the tea more than the price, store atmosphere, sales promotion and experience. A research was performed in Taiwan landscape coffee shops by Huang & Hou [11]. The study aimed to determine the customers' coffee taste using AHP model. Customers preferred Italian coffee and Americano coffee the most compared to hand dripping. Similar research was done on fast food franchises by Wibowo & Tielung [18] who investigated the criteria that influenced customers' intention in fast food selection. Their findings indicated that the most important criterion was price followed by cleanliness and atmosphere. McDonald's was identified as the most preferred fast food restaurant followed by KFC and A&W. Meanwhile, an empirical study was performed by Lam et al. [19] who studied the preference of fast food selection among the undergraduate students.

Price, customer service as well as cleanliness were the most influential criteria in selection of fast food restaurant. In their study, McDonald was once again identified as the most preferred fast food restaurant. Besides that, AHP has been widely used in other sectors such as mobile network operators [20]-[21], social network sites [22] supermarket [23], team leader [24], job [25], futsal court [15] and machine-tool [26]. All these studies have showed the robustness of AHP model in solving MCDM problems.

The next section describes the data and methodology. Section 3 presents the empirical results of this study and section 4 concludes the paper.

2.   Data and Methodology

AHP is a decision-making model which helps to solve MCDM problem [27], [23]. Figure 1 presents the proposed conceptual framework to evaluate the preference of coffee shop among the undergraduate students with AHP model.
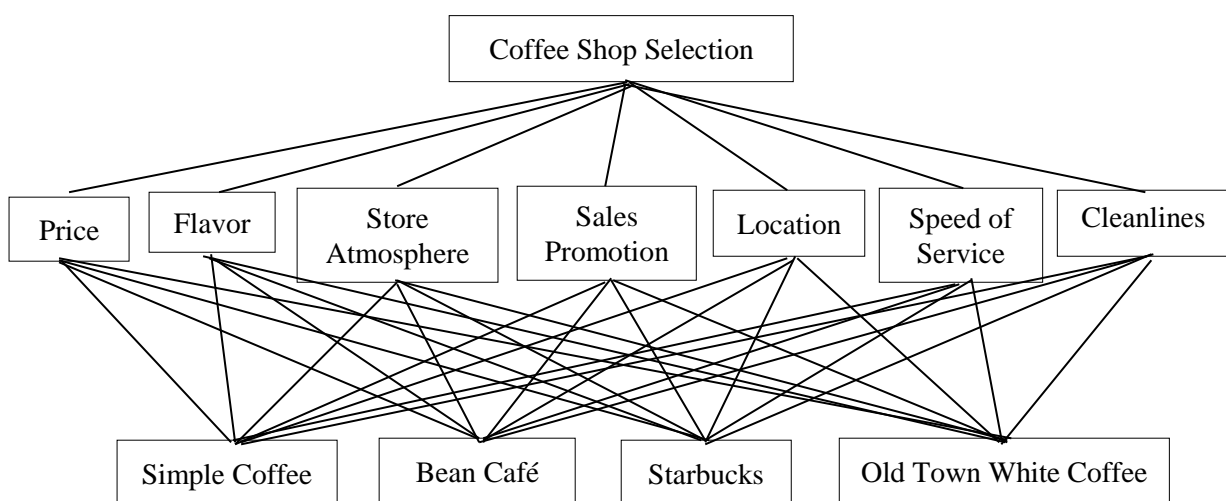

Figure 1. Proposed conceptual framework with AHP model

In this study, the proposed conceptual framework is illustrated with a case study in Universiti Tunku Abdul Rahman (UTAR) Kampar Campus, Malaysia. The decision criteria identified in this study are price, flavor, store atmosphere, sales promotion, location, speed of service and cleanliness. Simple Coffee, Bean Café, Starbucks and Old Town White Coffee are the decision alternatives in this study. The target respondents are the UTAR Kampar undergraduates who have visited all selected

coffee shops in Kampar. Survey has been conducted in this study through questionnaire.

The methodology for AHP model is divided into the following steps:

Step 1: Develop a conceptual framework to decompose the problem into main objective, decision criteria and decision alternatives as shown in Figure 1.

Step 2: Data collection from the experts or decision makers. A pairwise comparison will be performed on the decision criteria as well as decision alternatives in terms of each criterion.

211

Int. J Sup. Chain. Mgt   Vol. 7, No. 4, August, 2018

Table 1 shows the definition of pairwise comparison ratio scale.

Table 1. Ratio scale used for pairwise comparison

Scale	Definition
1	Equal importance
3	Somewhat more important
5	Much more important
7	Very much more important
9	Absolutely more important
2, 4, 6, 8	Intermediate Values

Step 3: Formulate pairwise comparison matrix based on collected data. Given n decision criteria, there should be one $(n \times n)$ matrix for pairwise comparison between decision criteria. Given m decision alternatives, there should be n numbers of $(m \times m)$ matrixes for pairwise comparison between decision alternatives with respect to each decision criterion.

Step 4: Normalization of pairwise comparison matrix. Normalization is performed through division of column's elements over column's sum. Weights for each criterion and decision alternatives are calculated from the row's average of normalized matrix. Excel software is used in this study to calculate the weight for each criterion.

Step 5: Calculate the overall weights of matrix **F** by multiplying matrix **Q** and matrix **w**. Matrix **F** is the overall weights of decision alternatives, matrix **Q** is the weights of decision alternatives with respect to each decision criterion and matrix w is the weights of decision criteria. The formula is as shown:

F = Q x w   (1)

The best decision alternative will be the element with greatest weight in matrix **F**.

Step 6: Checking for consistency ratio (CR). CR value is calculated to determine the consistency of the results. If CR is smaller than 0.10, degree of consistency is satisfactory. Formulation of CR value is as below:

$$CR = \frac{CI}{RI}$$ (2)

$$CI = \frac{\lambda_{\max} - n}{n - 1}$$ (3)

CI is the consistency index, $\lambda_{\max}$ is the maximum eigenvalue and n is the number of decision criteria.

Random index (RI) is determined empirically as the average value of CI of a large sample of randomly generated comparison matrices. Table 2 indicates the random index (RI) with respect to number of decision criteria.

Table 2. Random Index

n	2	3	4	5	6	7	8	9	10
RI	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.51

3.   Result and Discussion

Figure 2 indicates the weightage of each decision criterion according to the preference of undergraduate students.
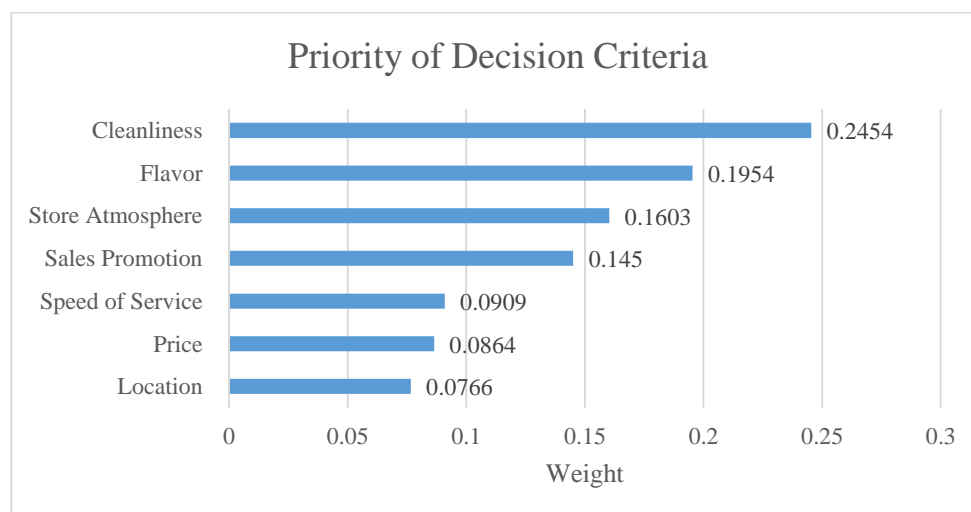

Figure 2. Priority of decision criteria

Cleanliness is ranked as the most significant criterion because it gives the highest weightage of 0.2454. The second and third decision criteria are flavor (0.1954) and store atmosphere (0.1603) respectively with a difference of 0.0351. This implies that cleanliness is the most influential decision criterion in selection of coffee shop among the undergraduate students followed by flavour and store atmosphere. The fourth and fifth criteria fall on sales promotion (0.1450) and speed of service (0.0909) respectively. Price (0.0864) and location (0.0766) are the least concern decision criteria by the undergraduates because they give the lowest weightage. Since the shops' location are concentrated in one area, therefore undergraduate students rank the location as the least important criterion in this study.

Figure 3 until Figure 9 presents the ranking of coffee shop with respect to each decision criterion. Higher number indicates higher ranking.
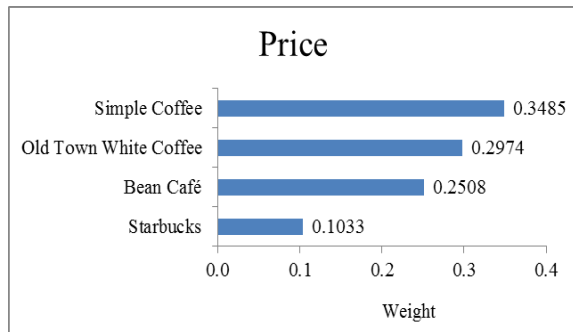

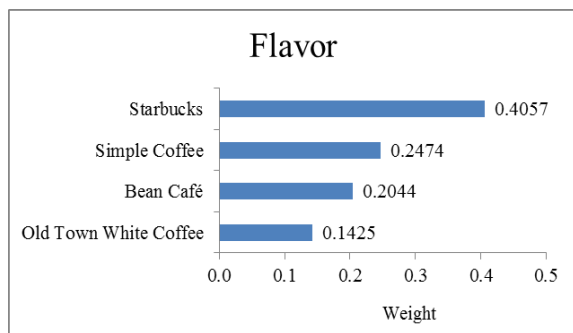**Figure 3**. Ranking of coffee shop with respect to price

Figure 4. Ranking of coffee shop with respect to flavor
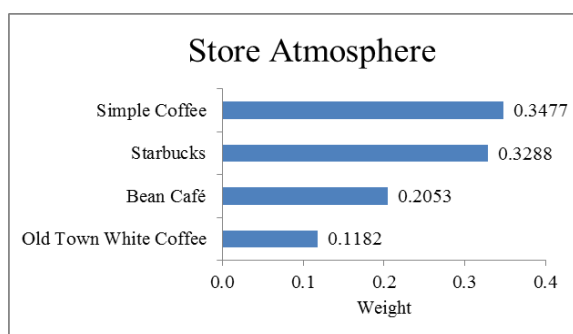

Figure 5. Ranking of coffee shop with respect to store atmosphere
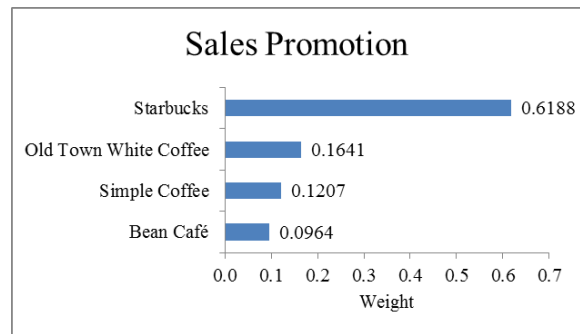

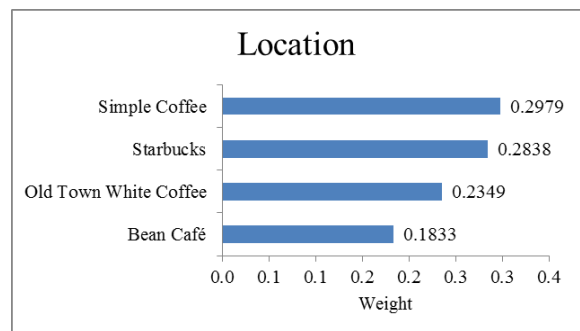**Figure 6**. Ranking of coffee shop with respect to sales promotion

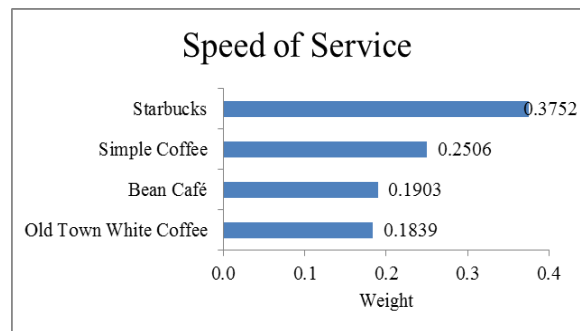**Figure 7**. Ranking of coffee shop with respect to location

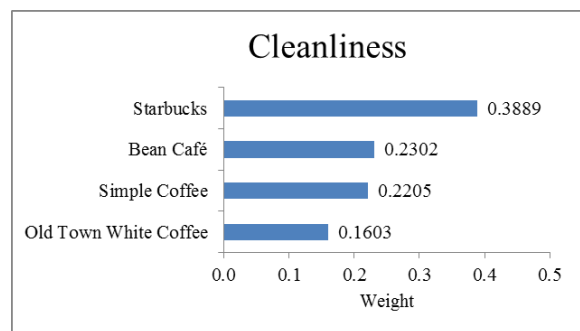**Figure 8**. Ranking of coffee shop with respect to speed of service

Figure 9. Ranking of coffee shop with respect to cleanliness

213

Int. J Sup. Chain. Mgt   Vol. 7, No. 4, August, 2018
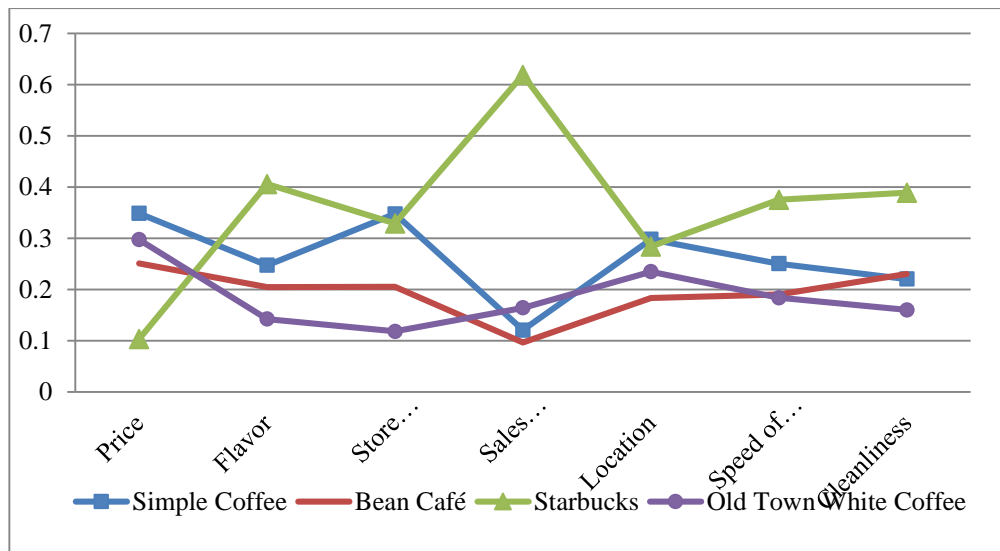
Figure 10. Comparison of coffee shops' ranking with respect to each decision criterion

Figure 10 is the combination of Figure 3 until Figure 9 in a line graph. As shown in Figure 10, Starbucks gives the highest ranking in four out of seven criteria which are flavor, sales promotion, speed of service and cleanliness. However, Starbucks coffee is the least preferred coffee shop with respect to price. Meanwhile, Starbucks (0.6188) has more promotion than other coffee shops which lead to a huge difference in the weightage of the criterion. Simple coffee obtains first ranking with respect to price, store atmosphere and location. The undergraduate students prefer Simple Coffee the most due to affordable price. Besides that, Simple Coffee is ranked as second with respect to flavor and speed of service which is right after Starbucks. Next, Bean Café is ranked as third preferred coffee shop most of the time with respect to price, flavor, store atmosphere and speed of service. However, it has the lowest ranking in sales promotion and location criteria. For Old Town White Coffee, it is ranked as the second with respect to price and sales promotion criteria. However, Old Town White Coffee is ranked as last under four criteria which are flavor, store atmosphere, speed of service and cleanliness.

Figure 11 indicates the overall performance of each coffee shop that ranked by the undergraduate students.
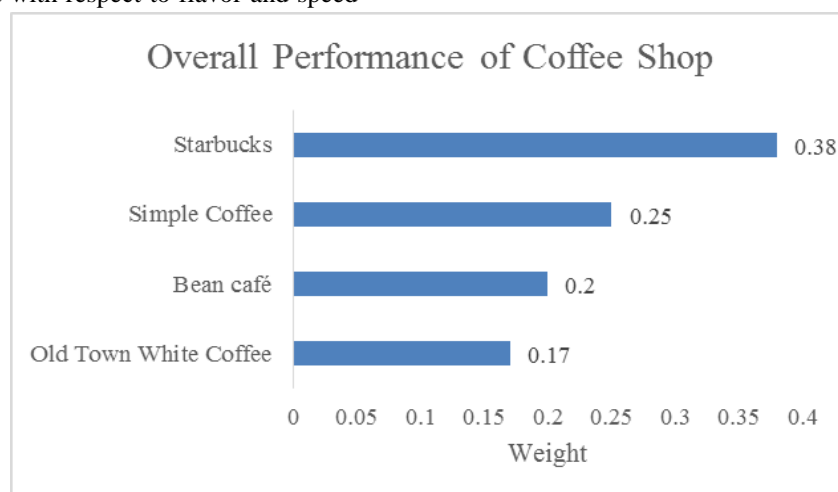

Figure 11. Overall Performance of Coffee Shop

As shown in Figure 11, Starbucks (0.38) is ranked as the most preferred coffee shop followed by Simple Coffee (0.25), Bean Café (0.20) and Old Town White Coffee (0.17). The findings show that most of the undergraduate students prefer Starbucks to other coffee shops in Kampar. Lastly, the consistency ratio of this study is 0.0184 and well below 0.1000. This implies that the degree of consistency is satisfactory and acceptable.

4.   Conclusions

In this study, a conceptual framework is proposed to evaluate the preference of coffee shop among the undergraduate students by using AHP model. The results of this study show that cleanliness, flavor and store atmosphere are the most influential decision criteria in selection of coffee shop among the undergraduate students. In addition, Starbucks is ranked as the most preferred coffee shop followed by Simple Coffee, Bean Café and Old Town White Coffee. This study helps to identify the most influential criteria in the selection of coffee shop as well as determine the preference of coffee shop among the undergraduate students in UTAR. The future research of this study can be extended to other group of people such as working adults besides undergraduate students.

Acknowledgments

References

[1] C.H.S. Ruxton, "*The impact of caffeine on mood, cognitive function, performance and hydration: A review of benefits and risks*", Nutrition Bulletin, Vol. 33, pp. 15-25, 2008.

[2] M. Lucas, F. Mirzaei, A. Pan, O.I. Okereke, W.C. Willett, É.J. O'Reilly, K. Koenen and A. Ascherio, "*Coffee, caffeine, and risk of depression among women*", Archives of Internal Medicine, Vol. 171, No. 17, pp. 1571-1578, 2011.

[3] N.D. Freedman, Y. Park, C.C. Abnet, A.R. Hollenbeck and R. Sinha, "*Association of coffee drinking with total and cause-specific mortality*", New England Journal of Medicine, Vol. 366, No. 20, pp. 1891-1904, 2012.

[4] A. Crippa, A. Discacciati, S.C. Larsson, A. Wolk, N. Orsini, "*Coffee consumption and mortality from all causes, cardiovascular disease, and cancer: A dose-response meta-analysis*", American Journal of Epidemiology, Vol. 180, No. 8, pp. 763-775, 2014.

[5] J-H. Bae, J-H. Park, S-S. Im, D-K. Song, "*Coffee and health*", Integrative Medicine Research, Vol. 3, pp. 189 -191, 2014.

[6] Muhammad and Sungplee, "*Factors of customer's preference of visiting coffee shop in South Korea*", International Journal of Sciences: Basic and Applied Research, Vol. 24, No. 7, pp. 252-265, pp. 2015.

[7] X. Lin, and Y. Zu, "*Multi-criteria GIS-based procedure for coffee shop location decision*", Degree Project Thesis, Bachelor, 15hp Geomatics, Study Programme in Geomatics. Hogskolan I Gavle, 2013.

[8] W.H. Ko and C.P. Chiu, "*A new coffee shop location planning for customer satisfaction in Taiwan*", International Journal of the Information Systems for Logistics and Management, Vol. 2, No. 1, pp. 55-62, 2006.

[9] M.A. Mighty, "*Site suitability and the analytic hierarchy process: how GIS analysis can improve the competitive advantage of the Jamaican coffee industry*", Applied Geography, Vol. 58, pp. 84-93, 2015.

[10] W.H. Lam, M.A. Din, W.S. Lam and J.W. Chen, "*Evaluation on the performance of suppliers in Malaysia with TOPSIS model*", Journal of Fundamental and Applied Sciences, Vol. 10, No. 6S, pp. 406-415, 2018.

[11] H.C. Huang and C. Hou, "*A study on coffee product categories sold in landscape coffee shops*", International Journal of Computer Science & Information Technology, Vol. 9, No. 3, pp. 71-78, 2017.

[12] O. Alfred, "*Influences of price and quality on consumer purchase of mobile phone in the Kumasi Metropolis in Ghana a comparative study*", European Journal of Business and Management, Vol. 5, No. 1, pp. 179-198, 2013.

[13] S.W. Su, "Tea or coffee: *A study of the beverage choice pattern and its affecting factors at teatime in Kaohsiung, Taiwan*", Asia Pacific Management Review, Vol. 12, No. 4, pp. 245-257, 2007.

[14] S. Neha and V. Manoj, "*Impact of sales promotion tools on consumer's purchase decision towards white good (refrigerator) at Durg and Bhilai region of CG, India*", Research Journal of Management Sciences, Vol. 2, No. 7, pp. 10-14, 2013.

[15] A. Tumbelaka, P. Kindangen and F.J. Tumewu, "*Customer decision making in selecting futsal court in Manado in terms of perceived quality: as application of Analytical Hierarchy Process (AHP)*", Jurnal EMBA, Vol. 3, No. 3, pp. 20-28, 2015.

[16] F. Bielen and N. Demoulin, "*Waiting time influence on the satisfaction-loyalty relationship in services*", Managing Service Quality: An International Journal, Vol. 17, No. 2, pp. 174-193, 2007.

[17] V.F. Pangkey, S.L.H.V.J Lapian and F. Tumewu, "*The analytical hierarchy process (AHP) of consumer purchase decision in selecting bubble tea shop*", Jurnal EMBA, Vol. 4, No. 2, pp. 323-331, 2016.

[18] S.W. Wibowo and M. Tielung, "*Analytical hierarchy process (AHP) approach on consumer preference in franchise fast food restaurant selection in Manado city*", Jurnal EMBA, Vol. 4, No. 2, pp. 22-28, 2016.

[19] W.S. Lam, J.W. Chen and W.H. Lam, "*An empirical study on the selection of fast food restaurants among the undergraduates with AHP model*", American Journal of Information Science and Computer Engineering, Vol. 2, No. 3, pp. 15-21, 2016.

[20] W.S. Lam, M.A. Bakar, W.H. Lam and K.F. Liew, "*Multi-criteria decision making in the*

215

Int. J Sup. Chain. Mgt   Vol. 7, No. 4, August, 2018

selection of mobile network operators with AHP-TOPSIS model", Journal of Engineering and Applied Sciences, Vol. 12, No. 23, pp. 6382-6386, 2017.

[21] H. Nasruddin, A. Norfaieqah and W.A. Wan Malissa, "*Selection of mobile network operator using Analytic Hierarchy Process (AHP)*", Advances in Natural and Applied Sciences, Vol. 7, No. 1, pp. 1-5, 2013.

[22] M.T. Chun and H.N. Miang, "*How do students select social networking sites? An Analytic Hierarchy Process (AHP) model*", International Journal of Cyber Society and Education, Vol. 8, No. 2, pp. 81-98, 2015.

[23] W.S. Lam, R.S. Bishan, W.H. Lam and K.F. Liew, "*An empirical evaluation on the preference of supermarkets with Analytic Hierarchy Process model*", Journal of Physics: Conference Series, Vol. 012037, pp. 1-9, 2018.

[24] A. Zahraa, O. Mazni, A. Mazida and A. Sinan, "*Team leader selection by using an Analytic Hierarchy Process (AHP) technique*", Journal of Software, Vol. 10, No. 10, pp. 1216-1227, 2015.

[25] W.S. Lam, W.K. Lee and W.H. Lam, "*Multi-criteria decision making in job selection problem using Analytic Hierarchy Process model*", Mathematics and Statistics Journal, Vo. 1, No. 2, pp. 3-7, 2015.

[26] W.S. Lam, R.S. Bishan and W.H. Lam, "*An empirical study on the mold machine-tool selection in semiconductor industry with Analytic Hierarchy Process model*", Advanced Science Letters, Vol. 23, No. 9, pp. 8286-8289, 2017.

[27] T.L. Saaty, *The Analytic Hierarchy Process*, New York: McGraw-Hill, 1980.

3.2.3 Sections heading