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An Integrated AHP-TOPSIS Approach to Staff Preferences for Coffee Shop Selection

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ABSTRACT

Coffee plays a vital role in supporting the daily routines and productivity of academic staff, yet many academic institutions provide limited café options that do not fully meet staff preferences. Despite the growing importance of coffee shops as spaces for work, leisure, and social interaction, few studies have systematically examined how staff evaluate and prioritise café attributes in campus environments. This study presents a comprehensive analysis of coffee shop attributes using an integrated Analytic Hierarchy Process (AHP) and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) approach, focusing on the preferences of academic staff. Data were collected from academic staff, treated as decision makers (DMs), who provided pairwise comparisons of criteria and ratings of café alternatives. Five main criteria such as flavour, price, atmosphere of the restaurant, speed of service and location were evaluated. The results show that flavour, price, and location emerged as the top priorities, while Nasken Coffee was ranked as the most preferred alternative among the three outlets studied. These findings offer actionable insights for campus administrators and coffee shop managers, helping to inform decision-making processes for service improvements. By combining AHP and TOPSIS, this study provides an alternative for evaluating service preferences, ensuring that the coffee shops meet the diverse needs of the campus community effectively.

1. Introduction

Coffee is one of the most widely consumed beverages worldwide, with consumption deeply embedded in both social and professional life. Its role extends beyond refreshment, providing physiological benefits that enhance focus, alertness, and productivity, which explains its popularity across diverse cultures and demographics, as highlighted by Higdon and Frei [7], Marquina *et al.*, [17], Nieber [18] and Nkondjock [19]. Among academic staff in particular, coffee is valued for sustaining

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concentration and supporting long working hours. Empirical studies have shown that caffeine consumption contributes to improved cognitive performance, reduced fatigue, and enhanced daily productivity as shown by Aliya and Putri Dahlia [1], Bae *et al.,* [2]; Marquina *et al.,* [17], Nieber [18]. For many professionals, including university's lecturer, coffee is not only functional but also an important part of their daily routines.

In Malaysia, coffee has evolved into a cultural symbol that blends traditional practices with modern lifestyle trends. The rapid expansion of both local "kopitiams" and international specialty coffee chains reflects the increasing demand for quality coffee experiences as observed by Lee *et al*., [15]. This growth demonstrates how coffee has become both a personal necessity and a marker of urban social life. The coffee trend is especially visible in university settings, where cafés have become key social hubs. Students and staff alike use them for academic discussions, collaborative projects, casual meetings, or simply relaxation, as noted by Aliya and Putri Dahlia [1] and Lee *et al*., [15]. The choice of coffee shops, however, involves multiple conflicting attributes such as flavour, price, service quality and speed, ambience, and location, as reported by Dhisasmito and Kumar [5], Lam *et al*., [12], Lee *et al*., [15], Vanharanta *et al*., [27], and Waxman [28]. Because these attributes are diverse and interdependent, conventional consumer analysis methods such as regression or simple surveys are limited in their ability to capture structured trade-offs. This has motivated researchers to employ Multi Criteria Decision Making (MCDM) techniques for evaluating coffee-related decisions.

Recent empirical studies further illustrate the applicability of structured decision-making methods in coffee shop contexts. The AHP is widely recognised for its ability to derive priority weights from structured pairwise comparisons. For instance, Lee [24] conducted a comparative study of coffee shop selection attributes using AHP, highlighting factors such as cleanliness, service quality, and store atmosphere as decisive in shaping consumer preferences. Similarly, Lam *et al*., [25] employed AHP to evaluate and prioritise factors influencing students' café choices, identifying cleanliness, store atmosphere, and flavour as critical decision criteria. Lasut *et al*., [14] applied AHP to urban café selection, while Fauzi *et al*., [32] used it to determine optimal business locations for coffee shops. Similarly, Chen [3] demonstrated the use of AHP in food service satisfaction. More recently, Thuanandee [26] analysed on-campus coffee shop attributes using AHP, focusing on student preferences for factors such as service quality, ambience, and pricing. These studies confirm AHP's usefulness for structuring judgments and identifying the relative importance of decision criteria. However, a key limitation of AHP is that it does not provide a direct ranking of alternatives once weights are established. TOPSIS complements AHP by ranking alternatives according to their distance from an ideal and negative-ideal solution. Yildiz and Yildiz [4] applied TOPSIS to café service evaluation, producing a clear ordering of alternatives. The method is also widely used in retail and hospitality research, where it allows both qualitative and quantitative criteria to be integrated. However, TOPSIS requires externally assigned weights, which introduces subjectivity and may weaken the robustness of the results if not combined with a structured weighting method.

To address these limitations, many researchers have adopted hybrid approaches that integrate AHP and TOPSIS. Siagian *et al*., [23] developed a recommendation system for coffee shop selection using this hybrid model, demonstrating its practicality in consumer decision support. Roumeliotou [20] evaluated e-service quality for Greek coffee chains with AHP–TOPSIS, while Ciptayani *et al*., [33] applied the model to assess export-grade coffee quality. In related areas, Lukic *et al*., [22] applied AHP–TOPSIS to food retail evaluation. More advanced integrations include the work of Gastélum-Chavira *et al*. [34], who combined AHP–TOPSIS with artificial intelligence for personnel selection in coffee shop companies. Beyond cafés, studies such as Zhao *et al*., [31] have shown that combining spatial, social, and economic data with decision models can optimise urban site selection, while, Jatiningrum *et al*., [10] successfully applied AHP–TOPSIS in marketplace selection, particularly reflecting the preferences of Generation Z.

Collectively, these studies confirm that hybrid AHP-TOPSIS frameworks are increasingly recognised as contemporary best practice in service evaluation, particularly due to their ability to integrate subjective expert judgement with objective performance measures. Building on this line of research, the present study applies an integrated AHP-TOPSIS model to the specific context of university cafés. Unlike previous works, it focuses on staff preferences within a higher education institution, thereby extending the application of AHP-TOPSIS into an underexplored but practically significant setting. This ensures that the findings not only align with state-of-the-art methodological developments but also provide context-specific recommendations for institutional service planning.

Despite these contributions, most studies focus on students, consumers, or products, with limited attention given to academic staff preferences. This represents a clear research gap in understanding how institutional café services can be optimised for faculty members. In Malaysia, for example, the Universiti Pertahanan Nasional Malaysia (UPNM) still offer limited or suboptimal café options. These offerings often fail to cater to the diverse and evolving preferences of university faculty, which encompass not just beverage quality but also factors such as pricing, location, service efficiency, and atmosphere. This disconnect underscores a critical gap in service planning within institutional infrastructure, particularly in aligning coffee shop amenities with the actual needs and preferences of academic professionals.

Therefore, this study employs a hybrid MCDM approach, integrating the AHP and the TOPSIS to evaluate existing coffee shops at UPNM from the perspective of university lecturers. AHP enables the derivation of criteria weights through expert pairwise comparisons while TOPSIS facilitates the ranking of alternatives based on their proximity to an ideal solution [13,30]. Specifically, as demonstrated by Chen [3], Fauzan *et al*., [6], Lasut *et al*., [14], Lee [24], Lam *et al*., [25] and Thuanandee [26], AHP method determines the relative importance of decision criteria through expert judgment and pairwise comparisons. TOPSIS, on the other hand, ranks alternatives based on their proximity to an ideal solution, which allows for systematic evaluation in contexts involving both qualitative and quantitative variables, as outlined by Yildiz and Yildiz [4]. By focusing on staff preferences within a university context, this study extends the application of hybrid decision-support methods into an underexplored but practically significant setting. The objective is to provide data-driven insights and actionable recommendations for improving campus café offerings, ultimately enhancing staff satisfaction and institutional service quality. Table 1 provides a summary of related studies that have applied AHP, TOPSIS, or hybrid AHP–TOPSIS approaches to coffee shop, retail, and service evaluation.

Table 1
Summary of related studies

Study	Method(s) Used	Context	Criteria Considered	Main Findings	Limitations / Gap
Chen [3]	AHP	Food service satisfaction	Service attributes	Demonstrated AHP captures relative importance of service criteria	No direct ranking of alternatives
Lasut *et al*., [14]	AHP	Urban café selection	Price, flavour, ambience, service	Showed AHP effective for prioritising café selection criteria	Did not integrate ranking of alternatives

Lee [24]	AHP	Consumer	cleanliness, service quality, and store atmosphere	preference attributes of coffee shop were relatively high in order of product, interior and exterior, brand and service	Did not integrate ranking of alternatives
Lam *et al*., [25]	AHP	University students (Malaysia)	Cleanliness, atmosphere, flavour	Identified cleanliness and store atmosphere as key factors influencing café choice	Focused only on students
Thuanandee [26]	AHP	University coffee shops, Thailand	Seven main criteria: (1) food & beverage quality, (2) pricing, (3) location, (4) environment, (5) staff service, (6) green practices, (7) brand recognition. Sub-criteria included hygiene, taste, value for money, promotional offers, and travel convenience.	Prioritised service environment and food quality for café quality improvement	Focused only on students
Fauzi *et al.,* [32]	AHP	Coffee shop business location	Location, rent cost, accessibility	Determined optimal location for new coffee shop businesses	Limited to locational analysis; excluded service quality
Yildiz and Yildiz [4]	TOPSIS	Café service evaluation	Service quality attributes	Ranked cafés based on service performance	Relied on external weights
Roumeliotou [20]	AHP–TOPSIS	Greek coffee chains (e-service)	E-service quality	Hybrid approach evaluated online service quality	Limited to digital cafés, not physical cafés
Lukic *et al*., [22]	AHP–TOPSIS	Food retail evaluation	Price, quality, accessibility	Demonstrated hybrid evaluation of retail sites	Broader retail scope, not coffee-specific
Siagian *et al*., [23]	AHP–TOPSIS	Coffee shop recommendation system	Price, taste, service quality	Built systematic recommendation model for shop selection	Limited to students; staff preferences not considered
Ciptayani *et al*., [33]	AHP–TOPSIS	Export-grade coffee	Bean quality, processing	Assessed export coffee quality	Focused on product quality, not service setting
Gastélum-Chavira *et al*., [34]	AHP–TOPSIS + AI	Coffee shop staff selection	Skills, experience, performance	Combined MCDM with AI for HR decision support	HR context, not consumer preference

Zhao *et al*., [31]	Spatial + economic data	Urban café site selection	Location, socio-economic variables	Optimised urban café placement	Focused on location; no structured MCDM framework

2. Methodology

This study adopts an integrated MCDM approach combining the AHP and the TOPSIS to evaluate and rank campus-based coffee-shop alternatives according to academic staff preferences at UPNM. The methodology consists of the following key stages:

2.1 Data Collection

Primary data were collected using a structured questionnaire. The questionnaire consisted of two sections. In Section A, Pairwise comparisons of criteria based on AHP is to determine the relative importance of each criterion. In Section B, rating of selected coffee shop alternatives against each criterion using a Likert scale, for use in TOPSIS analysis. Academic staff who drink coffee daily were treated as domain decision makers (DMs) and participated in the process. A total of $p = 5$ DMs participated. Five criteria to determine the decision were considered: price, flavour, speed of service, restaurant atmosphere and location. These criteria were validated via literature review [24, 25, 26] as well as preliminary discussions with a small group of staffs to ensure relevance and clarity. The AHP approach was applied to calculate each criterion's weight, while TOPSIS was used to obtain the alternative ranking of coffee shops.

2.2 AHP

The AHP is a structured MCDM technique developed by Saaty [21]. It allows for decision problems to be broken down into a hierarchy of goals, criteria, and alternatives, facilitating pairwise comparisons to quantify subjective preferences. In this study, AHP was used to determine the relative importance (weights) of the evaluation criteria for coffee shop selection. Notation used in AHP stage were introduced as following:

p	number of DMs involved
n	number of criteria
m	number of alternatives
$i = 1, \cdots, m$	index for alternatives
$j = 1, \cdots, n$	index for criteria (rows)
$k = 1, \cdots, n$	index for criteria (columns)
a_{jk}	entry in the pairwise comparison matrix of criteria
r_{jk}	Normalized entry in the pairwise matrix
w_j	weight of criterion j

The methodology for AHP model is divided into following steps:

1. Identify the problem and its objectives
2. Construct a conceptual framework also known as hierarchical diagram to divide the issue into three levels; a primary goal, selection criteria, and selection options (alternatives).

3. Constructing a pairwise comparison matrix for all criteria. It describes the relative importance of each element towards the objective or the element in the level immediately above by using the ratio scale shown in Table 2. The example of a pairwise comparison is presented in Equation 1.

Table 2
Pairwise comparison ratio scale

Scale	Definition
1	Equal Importance
3	Moderate Importance
5	Essential Importance
7	Very Strong Importance
9	Extreme Importance
2,4,6,8	Intermediate Values

For n criteria, construct one $n \times n$ pairwise comparison matrix $A = [a_{jk}]$. The reciprocal property holds:

$$a_{jk} = \frac{1}{a_{kj}}, \quad a_{jj} = 1 \tag{1}$$

For m alternatives, construct n matrices of size $m \times m$, each corresponding to comparisons of alternatives with respect to one criterion.

4. Normalise data by dividing each elements value in the pairwise comparison matrix (Step 3) with the total value for each column. For criteria matrix $A = [a_{jk}]$:

$$r_{jk} = \frac{a_{jk}}{\sum_{i=1}^{n} a_{ik}} \qquad j, k = 1, \cdots, n. \tag{2}$$

The weight for criterion j is then calculated as the row average:

$$w_j = \frac{1}{n}\sum_{k=1}^{n} r_{jk}\,, \qquad j = 1, \cdots, n. \tag{3}$$

5. The maximum eigenvalue, λ_{max} is estimated as:

$$\lambda_{max} = \frac{1}{n}\sum_{j=1}^{n} \frac{(Aw)_j}{w_j}. \tag{4}$$

6. The final step for validating the consistency is by calculating the consistency ratio, CR as follows:

$$CR = \frac{CI}{RI}, \qquad CI = \frac{\lambda_{max} - n}{n - 1} \tag{5}$$

Where CI is consistency index and RI is random index. The RI is obtained based on the number of criteria, as shown in Table 3,

Table 3
Random Index,RI [21]

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Consistency calculation is needed for proving the consistency level of the DMs' answers and the hierarchy structure. The value of CR has to be less than 0.1 [21, 29] to indicate that the pairwise comparisons are consistent, and the result can be used to be next processed with TOPSIS. If the CR has a value higher than 0.1, it means the judgments should be re-evaluated. At this stage, the vector of weights $w = (w_1, w_2, \cdots, w_n)^T$ is obtained. These weights are used directly in the next phase, the TOPSIS method.

2.2 TOPSIS

The TOPSIS was originally introduced by Hwang and Yoon [8] and later formalised by Yoon [28]. The fundamental idea behind TOPSIS is to identify the best alternative as the one that is nearest to the ideal solution and furthest from the least desirable option. In the TOPSIS method, criteria are generally classified into two types: benefit criteria and cost criteria. Benefit criteria refer to attributes where a higher value is more desirable, meaning the decision-maker aims to maximize these values. Examples include customer satisfaction, quality ratings, and performance scores. In contrast, cost criteria are attributes where a lower value is preferred, and the goal is to minimize them. Typical examples of cost criteria include price, error rate, or time taken to complete a task. Notation used in TOPSIS were introduced as follows:

m	number of alternatives
x_{ij}	performance value of alternative i on criterion j
z_{ij}	normalised performance value of alternative i on criterion j
v_{ij}	weighted normalized performance value
v_j^+, v_j^-	ideal best and ideal worst solution for criterion j
S_i^+, S_i^-	Euclidean distance of alternative i from ideal best and ideal worst solution
P_i	performance score of alternative i

The methodological steps are adapted from Lamrani Alaoui [13] and are explained as follows.

1. Construct the decision matrix.

$$X = [x_{ij}], i = 1, \cdots, m; j = 1, \cdots, n \tag{6}$$

2. Normalised the decision matrix

$$z_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}, i = 1,2, \dots, m ; j = 1,2, \dots, n \tag{7}$$

3. Construct weighted normalised decision matrix

$$v_{ij} = w_j \times z_{ij}, \qquad i = 1,2, \dots, m ; j = 1,2, \dots, n \tag{8}$$

where w_j were the weights from AHP.

4. Identify ideal best and ideal worst solutions

$$v_j^{+} = \begin{cases} max_i v_{ij}, & j \in J_B \\ min_i v_{ij}, & j \in J_C \end{cases}, \qquad v_j^{-} = \begin{cases} max_i v_{ij}, & j \in J_B \\ min_i v_{ij}, & j \in J_C \end{cases} \tag{9}$$

where v_j^{+} is ideal best value and v_j^{-} is ideal worst value, J_B and J_C are sets of benefit and cost criteria respectively. During the TOPSIS process, these classifications are crucial because the ideal best solution is constructed by selecting the maximum values for benefit criteria and the minimum values for cost criteria. Conversely, the ideal worst solution consists of the lowest values for benefit criteria and the highest values for cost criteria. This distinction directly affects how alternatives are evaluated and ranked in the decision-making process.

5. Calculate Euclidean distance

$$S_i^{+} = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^{+}\right)^2} \tag{10}$$

$$S_i^{-} = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^{-}\right)^2} \tag{11}$$

where S_i^{+} is the Euclidean distance from ideal best and S_i^{-} is the Euclidean distance from ideal worst

6. Calculate performance score

$$P_i = \frac{S_i^{-}}{S_i^{+} + S_i^{-}} \tag{12}$$

7. Rank alternatives

   Alternatives are ranked in descending order of P_i. The higher the coefficient, the closer the alternative is to the ideal solution.

3. Results and Discussion

The AHP was applied to determine the weight for each criterion. Meanwhile, the TOPSIS method was applied to determine the ranking of the alternatives.

3.2 AHP Results

A conceptual framework to divide the issue into a primary goal, selection criteria, and selection options is indicated in Figure 1.

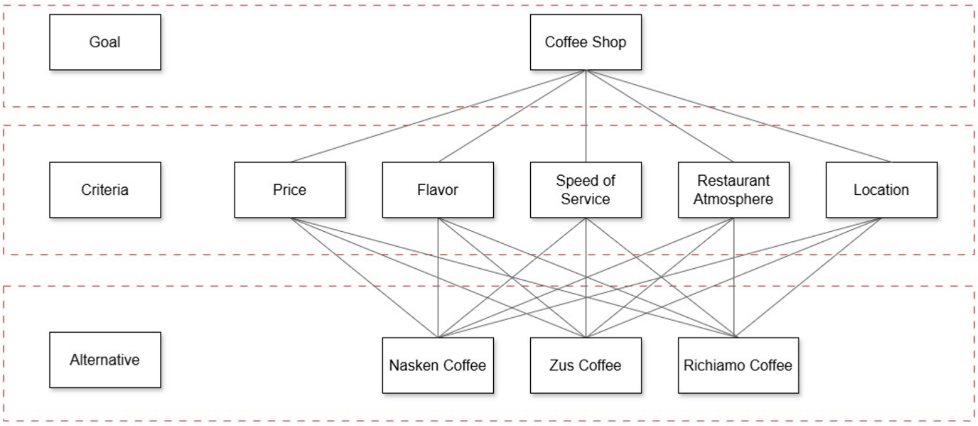

Fig. 1. AHP model-based conceptual framework

In Figure 1, there are three levels in the hierarchy: top, middle, and bottom. The primary goal is at the top-level indicating objectives, which is to select a coffee shop. The criteria are at the middle level illustrating the five criteria (price, flavour, speed of service, restaurant atmosphere and location). These criteria were determined based on literature. The decision options are at the bottom level, illustrating by 3 coffee shops alternatives (Nasken Coffee, Zus Coffee and Richiamore Coffee). These three shops were selected as alternatives since those are nearest and available at Sungai Besi Town. Those alternatives also have been operating at least 6 months at the time research was conducted.

Data were collected through interviews, during which DMs evaluated the criteria and alternatives using a pairwise comparison questionnaire. Figure 2 displays snippets of questionnaire distributed to DMs. The AHP analysis was conducted using a built-in Excel framework embedded with AHP algorithms, which allowed for the generation of multiple pairwise comparison matrices and automated calculation of individual priorities, aggregated weights, and consistency ratios. A customised AHP model was developed in Excel to facilitate the pairwise comparison and weight calculation process. The spreadsheet was structured to automatically normalise the pairwise comparison matrices, compute the eigenvector-based weights, and calculate the consistency ratio (CR). This ensured that the DMs' judgements were systematically processed and checked for consistency, while maintaining transparency of the steps. Table 4 and 5 present the pairwise and its normalized comparison matrix respectively, assessed by one of the DMs when evaluating the criteria.

Pairwise comparison scale between two criteria in term of price

Criteria A	Scale																	Criteria B
PRICE	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	FLAVOR
Criteria A	Scale																	Criteria B
PRICE	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	SPEED OF SERVICE
Criteria A	Scale																	Criteria B
PRICE	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	RESTAURANT ATMOSPHERE
Criteria A	Scale																	Criteria B
PRICE	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	LOCATION

Fig. 2. Sample of AHP questionnaire

Table 4
Pairwise Comparison matrix for criteria – a sample from a single respondent

	Price	Flavour	Speed	Atmosphere	Location
Price	1	6	4	1	1
Flavour	0.17	1	4	6	1
Speed	0.25	0.25	1	2	3
Atmosphere	1	0.17	0.5	1	1
Location	1	1	0.33	1	1

Table 5
Normalized Pairwise Comparison matrix for criteria – a sample from a single respondent

	Price	Flavour	Speed	Atmosphere	Location
Price	0.29	0.45	0.29	0.22	0.29
Flavour	0.05	0.23	0.44	0.33	0.14
Speed	0.07	0.06	0.15	0.22	0.29
Atmosphere	0.29	0.04	0.07	0.11	0.14
Location	0.29	0.23	0.05	0.11	0.14

The subsequent step in determining the rank of each criterion involves calculating their respective weights. Table 6 presents the rankings for the five criteria. The consistency level measured and for all DMs, the CR value is less than 0.1, meaning the pairwise comparison matrix and criteria weight did not contain inconsistencies

Table 6
Rank of decision criteria

Criteria	Average	Rank
Price	0.22	2
Flavour	0.25	1
Speed	0.192	4
Atmosphere	0.19	5
Location	0.2	3

The AHP results, as summarised in Table 6, reveal the relative importance of five key criteria used by staff in selecting a coffee shop. The criterion Flavour emerged as the most influential factor, with the highest average weight of 0.25, securing the first rank. This underscores that the quality and taste of beverages play a central role in the decision-making process. Price was identified as the second most important criterion with a weight of 0.22, indicating that affordability is also a significant consideration. This is followed by Location, which received an average weight of 0.20 and ranked third, suggesting that convenience and accessibility remain relevant to the staff's preferences. The criteria Speed and Atmosphere were ranked fourth and fifth, respectively, with average weights of 0.192 and 0.19. This finding suggests that academic staff prioritize the taste and quality of beverages over aesthetic elements. This aligns with findings by Lam *et al.*, [25] who found flavour and affordability to be the primary drivers in coffee shop selection among students in Malaysian universities. Similarly, Thuanandee [26] demonstrated the dominance of product quality over location and ambiance in urban café preference modeling.

On the other hand, the relatively low weight given to atmosphere suggests that lecturers view café as functional spaces that is often used for quick breaks or brief meetings rather than places for leisure. This observation is validated by the findings of Aliya and Putri Dahlia [1], who found that while ambiance influences revisit intent, it is often deprioritized by working professionals who frequent cafés for practical rather than aesthetic reasons. Taken together, these findings underscore the need for coffee shop operators near workplace areas to focus on delivering quality beverages at reasonable prices, while ensuring convenient access to attract and retain working professionals as regular customers. Overall, the AHP findings provide a structured insight into the hierarchy of preferences among staff members, serving as a critical input for the subsequent TOPSIS analysis to evaluate and rank the available coffee shop alternatives.

3.3 TOPSIS Results

The ranking of the alternatives was carried out by using TOPSIS method. The average score pairwise comparison matrix with respect to every criterion for all alternatives, from AHP is shown in Table 7.

Table 7
Evaluation of alternatives according to criteria

	Price	Flavour	Speed of Service	Restaurant Atmosphere	Location
Nasken Coffee	0.45	0.46	0.23	0.56	0.48
Zus coffee	0.28	0.30	0.28	0.20	0.22
Richiamore	0.27	0.24	0.38	0.25	0.24

The first step in TOPSIS is to construct normalized decision matrix using Equation (7). Table 8 shows the resulting normalized decision matrix.

Table 8
Normalized decision matrix

	Price	Flavour	Speed of Service	Restaurant Atmosphere	Location
Nasken Coffee	0.7565	0.7675	0.438	0.8681	0.8276
Zus coffee	0.4707	0.5006	0.5333	0.3100	0.3793
Richiamore	0.4539	0.4004	0.7237	0.3876	0.4138

Then, construct weighted normalized decision matrix using Equation (10). The weight will be used based on criteria weight from AHP method and multiplying it with normalized decision matrix. Table 9 shows the resulting weighted normalized decision matrix.

Table 9
Weighted normalized decision matrix

	Price	Flavour	Speed of Service	Restaurant Atmosphere	Location
Nasken Coffee	0.1664	0.1919	0.0841	0.1649	0.1655
Zus coffee	0.1036	0.1251	0.1024	0.0589	0.0759
Richiamore	0.0999	0.1001	0.1390	0.0736	0.0828

Next step is to calculate ideal best and ideal worst value. In here the benefit criteria is flavour, speed of service, restaurant atmosphere. These are attributes where higher values are more desirable, as they contribute positively to customer satisfaction and the overall dining experience. For these criteria, the ideal best value will be the maximum observed among all alternatives, representing the most favorable condition, while the ideal worst value will be the minimum, indicating the least preferred outcome. On the other hand, price and location are treated as cost criteria, where lower values are preferred. For example, a lower price is generally more attractive to customers, and a more convenient (closer) location is typically favored over a farther one. Hence, for cost criteria, the ideal best value is the minimum, and the ideal worst is the maximum. Table 10 display ideal best and ideal worst value for each criteria.

Table 10
Ideal best value and ideal worst value for each criterion

	Price	Flavour	Speed of Service	Restaurant Atmosphere	Location
Nasken Coffee	0.1664	0.1919	0.0841	0.1649	0.1655
Zus coffee	0.1036	0.1251	0.1024	0.0589	0.0759
Richiamore	0.0999	0.1001	0.1390	0.0736	0.0828
${V_j}^+$	0.0999	0.1919	0.1390	0.1649	0.0759
${V_j}^-$	0.1664	0.1001	0.0841	0.0589	0.1655

Next step is to calculate the Euclidean distance from ideal best using Equation (10) and (11). Table 11 shows the value of S_i^+ and S_i^- .

Table 11
Euclidean distance from ideal best and ideal worst value

Alternatives	S_i^+	S_i^-
Nasken Coffee	0.124	0.140
Zus Coffee	0.131	0.114
Richiamo	0.130	0.120

Final step is to calculate performance score using formulation in (12). The result of preference score shows in Table 12.

Table 12
Preference score

Alternatives	P_i
Nasken Coffee	0.529
Zus Coffee	0.466
Richiamo	0.482

Based on Table 12, Nasken Coffee has the highest preference score of 0.529, indicating it is the closest to the ideal solution among the three, and therefore, the most preferred option overall. Richiamo follows with a score of 0.482, slightly ahead of Zus Coffee, which has the lowest score of 0.466. This ranking suggests that, based on the weighted evaluation of all criteria, Nasken Coffee best meets the collective expectations of the decision-makers, making it the top recommendation.

Nasken Coffee emerged as the top-ranked alternative, most likely due to its strong performance in the benefit criteria, such as flavour, speed of service, and atmosphere which were assigned higher weights during the AHP phase. If Nasken consistently received higher ratings across these highly weighted benefit criteria, it would significantly improve its position in the TOPSIS calculation. Additionally, even if its cost-related attributes (price or location) were moderate, its overall proximity to the positive ideal solution would still be the highest. Nasken's leading position can be attributed to its strong performance on high-weight criteria like flavour and price, and its broader food menu, making it suitable for both meals and casual meetings. This preference is consistent with the broader trend of favoring multi-functional cafés, as observed in other campus-based consumer research Lam *et al*., [12].

Richiamo ranked second, suggesting it performed reasonably well across several criteria, possibly including one or both cost criteria i.e. having a more affordable price or favorable location. However, it may have slightly underperformed compared to Nasken in key benefit criteria, which limited its closeness to the ideal solution. Interestingly, Zus Coffee, despite its technological advantages like mobile ordering apps, ranked last. This outcome underscores that digital convenience does not outweigh core decision attributes such as product quality and pricing. The findings suggest that academic staff prioritize substance over branding or technological integration, which is a nuance that decision-makers should consider when planning new food and beverage outlets. This could be attributed in particular to lower scores in benefit criteria, such as a less favorable perception of flavour or atmosphere, or possibly higher cost, including more expensive pricing or a less convenient location. Given that both price and location were treated as cost criteria, higher values in these areas would push Zus further from the ideal solution. The ranking reflects how each alternative balanced performance (benefit criteria) with cost-effectiveness (cost criteria), all weighted according to decision-maker priorities. Nasken's top position suggests it achieved the most favorable trade-off between quality and cost from the perspective of the DMs.

4. Conclusions

This study successfully implemented an integrated AHP and TOPSIS model to analyse coffee shop preferences among academic staff at the UPNM. The hybrid MCDM framework provided structured insights into how various service attributes influence decision-making in a university environment, supporting evidence-based planning for campus service enhancements. From the AHP analysis, five key criteria were ranked according to lecturer preferences: flavour, price, location, speed of service, and atmosphere. The dominance of flavour as the top criterion reflects the importance placed on taste and beverage quality by lecturers, who likely seek a satisfactory sensory experience during their breaks or between lectures. Price followed closely, indicating cost sensitivity despite their professional roles. Location ranked third, highlighting the preference for convenience due to tight schedules. Speed of service was next, valued for time efficiency, especially during short intervals between classes or meetings. Interestingly, atmosphere ranked the lowest, suggesting that many lecturers visit cafés not for leisure but for practical purposes such as brief meetings or quick refreshments thus ambiance plays a secondary role.

The TOPSIS evaluation further refined these insights by ranking the coffee shop alternatives. Nasken Coffee emerged as the most preferred option, followed by Richiamo, with Zus Coffee ranking last. This outcome may appear surprising given Zus's technological convenience i.e. mobile ordering app, but the findings suggest that digital accessibility alone is insufficient. DMs prioritized flavour and variety of offerings over tech features. Nasken's higher ranking may stem from its broader menu, offering both food and beverage making it a more comprehensive choice for meals and informal meetings. This aligns with the observed trend at UPNM where new cafés like Dolceza adopt a similar concept to Nasken, emphasizing food variety over beverage diversity alone. In contrast, Zus Coffee, though well-branded and digitally accessible, may have ranked lower due to its limited food options, a factor potentially critical for staff who prefer cafés that accommodate both drink and meal needs. If the DMs had been students instead of staff, it is plausible that Zus would have scored higher due to its beverage range and digital integration, indicating that user profile significantly affects decision priorities.

This study underscores the utility of AHP-TOPSIS in understanding nuanced consumer preferences in institutional settings. It provides actionable recommendations for campus administrators and café operators particularly, to emphasize quality flavour profiles, maintain competitive pricing, ensure strategic locations, and offer diverse food options. Future research should broaden the respondent pool to include students and non-academic staff. Additionally, incorporating sub-criteria—such as low pricing, value for money, and frequent promotional offers under the main criterion of price, as suggested by Thuanandee [26] would contribute to developing a more comprehensive and robust decision-making model.

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