

Enhancing Regional Tourism: Ranking Tourism Destinations in Perlis using Fuzzy TOPSIS based on Internal Motivational Factors

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ABSTRACT

Despite being Malaysia's smallest and most northern state, Perlis offers diverse tourist destinations that combine natural beauty and cultural heritage. The Visit Perlis 2024-2025 campaign has boosted tourism efforts. However, tourism planners encounter difficulties in understanding and ranking destinations due to the subjective and complex nature of tourist preferences. This study aims to evaluate and rank tourism destinations in Perlis by focusing on internal motivational factors such as psychological factors, physical factors, social interaction, and seeking/exploration. Expert evaluations were conducted using structured questionnaires to collect data from 19 popular tourist attractions. The fuzzy TOPSIS method was utilised to cope with the inherent complexity and vagueness associated with human judgment in tourism decision-making. Four tourism experts assessed the significance of each criterion as well as the performance of each destination. The results revealed that psychological factors greatly influenced tourist decisions, followed by social interaction, seeking/exploration, and physical factors. Pasar Terapung JPS Perlis emerged as the top-ranked destination with a closeness coefficient (CC) of 0.5377 due to its unique floating market experience similar to that in Thailand. It was closely followed by Taman Anggur Perlis (CC = 0.5373) and Nat Pokok Getah (CC = 0.5371). Conversely, lower-ranked destinations such as Muzium Kota Kayang (CC = 0.5326) highlight a need for more engaging and interactive visitor experiences. This study offers valuable information for stakeholders, including tourism planners, travel agencies, and policymakers, to customise marketing strategies, upgrade infrastructure, and enrich visitor experiences. It emphasises the need to strategically integrate tourism development initiatives with tourists' intrinsic motivations, preferences, and experiential expectations in order to foster a more sustainable, competitive, and long-term tourism growth trajectory in Perlis.

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1. INTRODUCTION

Tourism is a vital economic sector that contributes to national income and employment. In 2024, tourism contributed US\$10.9 trillion to global GDP, accounting for 10% of the world economy and providing 357 million employment, or about one in every ten jobs worldwide (World Bank Group, 2025). In Malaysia, Tourism Malaysia (2025) reports that the country received over 37.96 million visitors in 2024, resulting in RM106.8 billion in tourism revenue. Understanding its important role in socio-economic growth, Malaysia continues to boost domestic and international tourism campaigns. Among the participating states, Perlis has aggressively promoted its tourist offers via the "Visit Perlis 2024-2025" campaign, with the slogans "Perlis Damai dan Menawan" and "Perlis - The Undeniable Charm". This effort includes various cultural and ecotourism events, such as the Pesta Angin Timur Perlis 2025 (PAT 2025), which aims to establish Perlis as a competitive tourist centre in northern Malaysia. While Perlis recorded almost one million visitors for the first two months of 2025 (Utusan Malaysia, 2025), tourism planners struggle to understand and rank destinations to align with tourists' motivations due to a lack of structured or data-driven methods. Conventional methods are often inadequate to address the subjective and complex nature of tourist preferences. Destination preference is significantly influenced by internal motivational factors (He et al., 2025; Pan et al., 2024; Yoo et al., 2018), particularly the psychological factor (Çelik & Dedeoğlu, 2019; Hsu et al., 2009; Mohamad & Jamil, 2012), physical factor (Hsu et al., 2009; Mohamad & Jamil, 2012), social interaction (Hsu et al., 2009; Mohamad & Jamil, 2012; Wu et al., 2023), and seeking/exploration (Hsu et al., 2009; Mohamad & Jamil, 2012; Oshriyeh et al., 2022). To customise marketing strategies, upgrade infrastructure, and enrich visitor experiences, a deeper understanding of these motives is necessary.

However, the process of selecting the tourist preference destination is a complex decision-making process that incorporates multiple factors. To address this gap, multi-criteria decision-making (MCDM) methods, such as the Fuzzy Technique for Order of Preference by Similarity to Ideal Solution (fuzzy TOPSIS), are adopted. In contrast to traditional methods, fuzzy TOPSIS combines fuzzy logic and TOPSIS to accommodate expert judgment and uncertainty in decision-making processes. This combination makes it ideal for selecting tourist preference destinations where qualitative judgements are dominant (Buasri & Sangpradid, 2025; Guo et al., 2019; Morteza et al., 2016). The number of studies employing fuzzy-based models in the tourism industry is steadily increasing. For instance, Mohamad and Jamil (2012) used Fuzzy Hierarchical TOPSIS to evaluate and select destinations in Kedah, integrating the same internal motivational factors. Other studies by Nilashi et al. (2019) have applied DEMATEL and fuzzy TOPSIS to identify the factors influencing the development of medical tourism in Malaysia. Meantime, Buasri and Sangpradid (2025) and Guo et al. (2019) demonstrate the effectiveness of fuzzy TOPSIS in addressing subjective and multi-criteria decision-making. They achieve this by generating precise and interpretable rankings, which enable practical upgrades in tourism planning and customised recommendations. These studies continuously emphasise the need for organised and quantitative assessment methods in improving tourist planning and policy development.

Driven by this context, this study aims to investigate the preferences that influence tourist destination selections in Perlis, focusing on internal motivational factors and ranking tourism destinations based on each factor. This study is beneficial to the state government, tourism planners, and travel agencies in promoting Perlis as an attractive tourist destination in Malaysia to attract more tourists both locally and internationally.

2. METHODOLOGY

This study employs the fuzzy TOPSIS method proposed by Zouggari and Benyoucef (2012) to evaluate and rank tourism destinations in Perlis, focusing on internal motivational factors. The process was divided

into three stages: criteria and alternatives selection, experts and linguistic scale and computational procedures.

2.1 Criteria and alternatives selection

The evaluation considers four main criteria: Psychological Factor (C_1), Physical Factor (C_2), Social Interaction (C_3), and Seeking/Exploration (C_4), as derived from Hsu et al. (2009) and further adapted by Mohamad et al. (2012). Nineteen notable tourism destinations in Perlis were identified as alternatives: Arked Niaga Padang Besar (A_1), Bukit Tok Dun (A_2), Galeri 3D Gua Kellam (A_3), Kampung Wai (A_4), Kangar Street Art (A_5), Kampung Warisan Tradisi Nelayan (A_6), Muzium Kota Kayang (A_7), Superfruits Valley (A_8), Taman Anggur Perlis (A_9), Taman Eko-Rimba Bukit Ayer (A_{10}), Taman Rekreasi Tasik Melati (A_{11}), Tasik Timah Tasoh (A_{12}), Wang Kelian View Point (A_{13}), Nat Pokok Getah (A_{14}), Bukit Chabang (A_{15}), Pasar Terapung JPS Perlis (A_{16}), Taman Negeri Perlis (A_{17}), Pusat Kecemerlangan Mempelam Harum Manis (A_{18}) and Taman Ular Dan Reptilia Negeri Perlis (A_{19}). These places were selected based on their popularity and participation in state-promoted tourism campaigns. The criteria and alternatives are the main elements in this study, and a group of experts assesses their relationship and reliance in decision-making. Fig. 1 illustrates the relationships and dependencies between the criteria and alternatives.

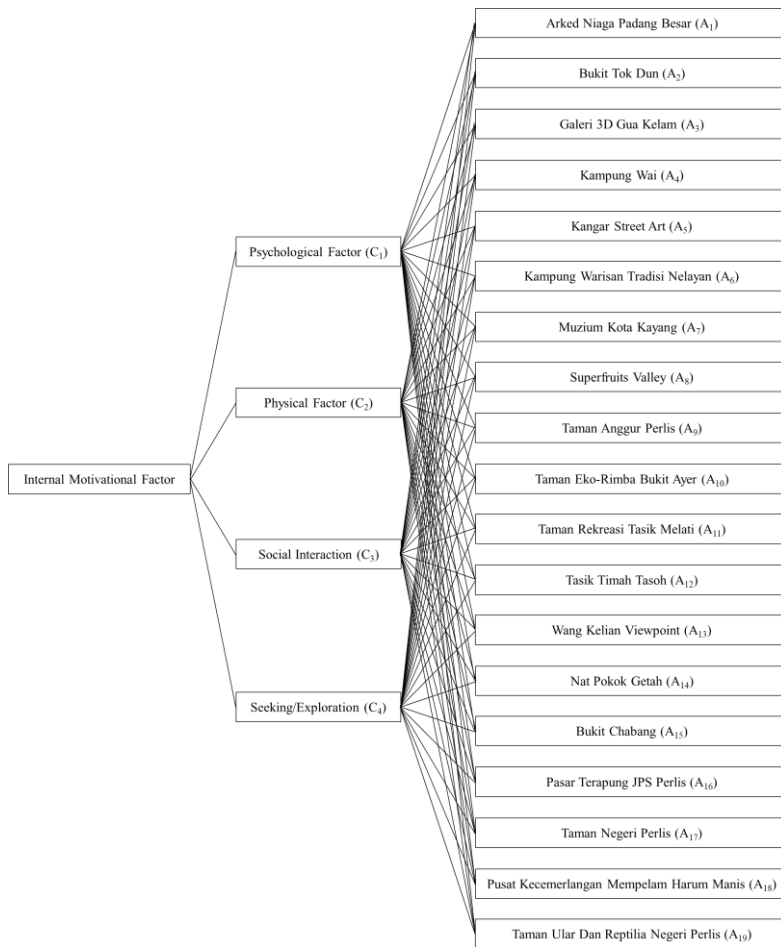


Fig. 1. The dependency structure of criteria and alternatives.

The criteria used in this study are described as follows:

Psychological Factor (C₁): Fundamental personal factors that influence a tourist's decision to travel, derived from psychological needs, motivations, and preferences, such as escape and self-actualisation.

Physical Factor (C₂): Physical, sensory, and emotional needs that influence travel decisions, including the desire for rest, medical treatment, health improvement, and fitness-related activities.

Social Interaction (C₃): The motivation to interact with others, strengthen relationships, visit friends or relatives, and meet new people during travel.

Seeking/Exploration (C₄): The desire to explore new destinations, cultures, and experiences to satisfy curiosity, gain knowledge, and experience novelty, including activities such as shopping, nightlife, cultural exploration, and adventure.

2.2 Experts and linguistic scale

A panel of four experts, comprising academic researchers and industry practitioners, was selected based on their expertise and involvement in Perlis' tourism sector. This panel reflects the study's emphasis on expert judgement within real-world ambiguity. Table 1 summarises the biographical data of experts.

Table 1. Biographical data of experts

Biodata	Expert 1 (E ₁)	Expert 2 (E ₂)	Expert 3 (E ₃)	Expert 4 (E ₄)
Domain of expertise	Community-based tourism education	Hospitality operations	Tour operations	Tourism business
Position	Senior lecturer	Office assistant	Tour operator	Director
Years of experience	10	5	8	20

This study uses Triangular Fuzzy Numbers (TFNs) to represent the linguistic terms of a Likert scale. The TFNs corresponding to the four-point Likert scale were implemented to assess the significance of the criteria. In contrast, a five-point Likert scale was employed to evaluate the performance of the alternatives, as shown in Table 2 and Table 3.

Table 2. Four-point Likert Scale and its Triangular Fuzzy Number

Scale	Linguistic Scale	Triangular Fuzzy Number
1	Slightly Important (SI)	(1,1,3)
2	Moderately Important (MI)	(1,3,5)
3	Somewhat Important (SWI)	(5,7,9)
4	Extremely Important (EI)	(7,9,9)

Table 3. Five-point Likert Scale and its Triangular Fuzzy Number

Scale	Linguistic Scale	Triangular Fuzzy Number
1	Not At All Important (NI)	(1,1,3)
2	Slightly Important (SI)	(1,3,5)
3	Moderately Important (MI)	(3,5,7)
4	Somewhat Important (SWI)	(5,7,9)
5	Extremely Important (EI)	(7,9,9)

2.3 Computational process

The computational process begins by defining the relevance of criteria and then evaluating alternatives based on those criteria. These numerical data indicate the relative relevance of the criteria and the differences between the two choices using fuzzy numbers. The relevance of the criteria and the differences between the two choices are combined to produce a closeness coefficient. The entire computational technique is divided into multiple steps, which ensure proper data normalisation and the translation of qualitative linguistic data into fuzzy numbers. The remainder of the computational operations employs the conventional fuzzy TOPSIS approach, which is used to rank alternatives based on the respective criteria. This research is to address the issue of ranking destinations based on internal motivating factors. Given the qualitative linguistic data utilised in this study, the fuzzy TOPSIS method is ideal for dealing with inherent uncertainty and generating a solid ranking of alternatives. The flowchart for the computational process is illustrated in Fig. 2.

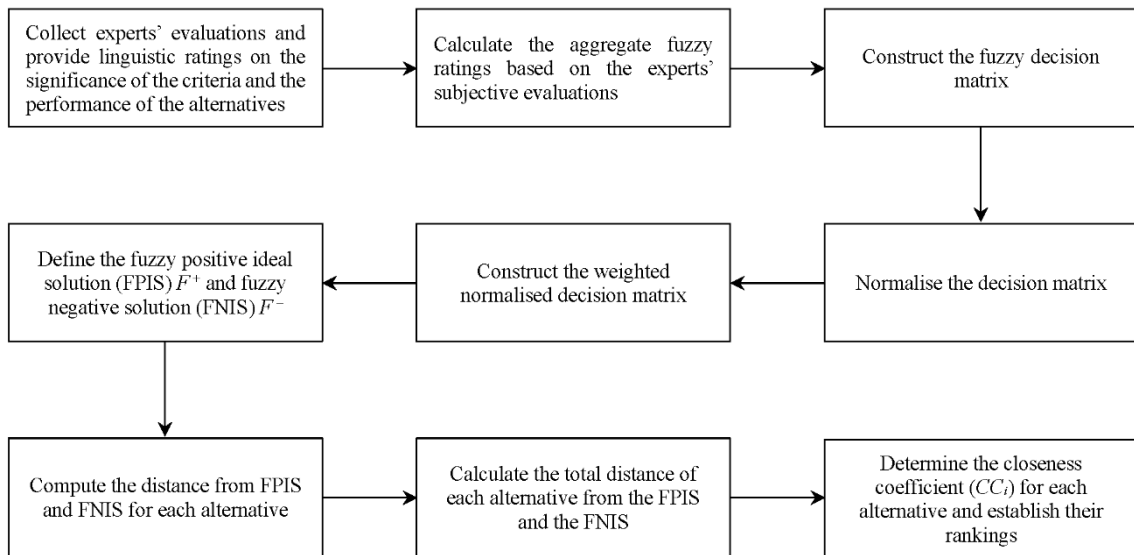


Fig. 2. Flowchart for the computational process.

Details of the computational procedures are described as follows.

Step 1: Collect experts' evaluations and provide linguistic ratings on the significance of the criteria and the performance of the alternatives.

Suppose there are k experts. The significance of the criteria using fuzzy ratings was assigned by the k^{th} expert for the i^{th} alternative on the j^{th} criterion is denoted as $w_{ij}^k = (a'_{ij}, b'_{ij}, c'_{ij})$. Similarly, the fuzzy rating given by the k^{th} expert for the i^{th} alternative on the j^{th} criterion is represented as $\tilde{x}_{ij}^k = (a_{ij}^k, b_{ij}^k, c_{ij}^k)$.

Step 2: Calculate the aggregate fuzzy ratings based on the experts' subjective evaluations.

The aggregated fuzzy weights w_{ij}^k for each criterion are presented by $w_{ij}^k = (a'_{ij}, b'_{ij}, c'_{ij})$, where

$$a'_{ij} = \min_k \{a'_{ij}\}, b'_{ij} = \frac{1}{K} \sum_{k=1}^K b'_{ij} \text{ and } c'_{ij} = \max_k \{c'_{ij}\} \tag{1}$$

The aggregated fuzzy ratings \tilde{x}_{ij}^k for alternatives i with respect to each criterion j are given by $\tilde{x}_{ij}^k = (a_{ij}^k, b_{ij}^k, c_{ij}^k)$, where

$$a_{ij}^k = \min_k \{a_{ij}^k\}, b_{ij}^k = \frac{1}{K} \sum_{k=1}^K b_{ij}^k \text{ and } c_{ij}^k = \max_k \{c_{ij}^k\} \tag{2}$$

Step 3: Construct the fuzzy decision matrix.

A fuzzy MCDM problem can be concisely represented in matrix format as follows:

$$W = [W_1 \ \dots \ W_n]$$

$$X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1j} \\ x_{21} & x_{22} & \dots & x_{2j} \\ \vdots & \vdots & \ddots & \vdots \\ x_{i1} & x_{i2} & \dots & x_{ij} \end{bmatrix} \tag{3}$$

where x_{ij} shows the rating of i^{th} alternatives with respect to j^{th} criteria. $i = 1, 2, 3, \dots, m$ is the number of alternatives and $j = 1, 2, 3, \dots, n$ is the number of criteria. Here, $x_{ij} = (a_{ij}, b_{ij}, c_{ij})$ and $w_j = (a'_j, b'_j, c'_j)$ are triangular fuzzy numbers representing linguistic variables.

Step 4: Normalise the decision matrix.

$$R_{ij} = [\tilde{r}_{ij}]_{m \times n} \tag{4}$$

$$\tilde{r}_{ij} = \left(\frac{a_{ij}}{c_j^+}, \frac{b_{ij}}{c_j^+}, \frac{c_{ij}}{c_j^+} \right), i = 1, 2, 3, \dots, m \text{ where } c_j^+ = \max_i (a_{ij}) \tag{5}$$

This process converts numerous attribute dimensions into non-dimensional attributes, allowing comparisons across criteria.

Step 5: Construct the weighted normalised decision matrix.

$$V = [\tilde{v}_{ij}]_{m \times n}, i = 1, 2, 3, \dots, m \text{ and } j = 1, 2, 3, \dots, n \tag{6}$$

$$\tilde{v}_{ij} = \tilde{r}_{ij} \times w_j \tag{7}$$

Step 6: Define the fuzzy positive ideal solution (FPIS) F^+ and fuzzy negative solution (FNIS) F^- .

$$F^+ = (\tilde{v}_1^+, \tilde{v}_2^+, \dots, \tilde{v}_n^+) \text{ where } \tilde{v}_j^+ = (1, 1, 1)$$

$$F^- = (\tilde{v}_1^-, \tilde{v}_2^-, \dots, \tilde{v}_n^-) \text{ where } \tilde{v}_j^- = (0, 0, 0)$$

Step 7: Compute the distance between FPIS and FNIS for each alternative.

$$F_{ij}^+ = \sqrt{\frac{1}{3} \left[\left(\tilde{v}_{ij}^+ - 1 \right)^2 + \left(\tilde{v}_{ij}^+ - 1 \right)^2 + \left(\tilde{v}_{ij}^+ - 1 \right)^2 \right]} \quad (8)$$

$$F_{ij}^- = \sqrt{\frac{1}{3} \left[\left(\tilde{v}_{ij}^- - 0 \right)^2 + \left(\tilde{v}_{ij}^- - 0 \right)^2 + \left(\tilde{v}_{ij}^- - 0 \right)^2 \right]} \quad (9)$$

Step 8: Calculate the total distance of each alternative from the FPIS and the FNIS.

$$d_i^+ = \sum_{j=1}^n d \left(\tilde{v}_{ij}^+, 1 \right), i = 1, 2, 3, \dots, m \quad (10)$$

$$d_i^- = \sum_{j=1}^n d \left(\tilde{v}_{ij}^-, 0 \right), i = 1, 2, 3, \dots, m \quad (11)$$

Step 9: Determine the closeness coefficient (CC_i) for each alternative and establish their rankings.

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-}, i = 1, 2, 3, \dots, m \quad (12)$$

Alternatives are ordered in decreasing order based on CC_i . The highest CC_i denotes the FPIS, which indicates the best choice and is near to 1. In contrast, the FNIS is furthest from zero.

3. RESULTS AND DISCUSSIONS

3.1 Data Analysis and implementation

The fuzzy TOPSIS method was used to evaluate and rank tourism destinations in Perlis, focusing on internal motivational factors: psychological factor, physical factor, social interaction, and seeking/exploration. The method utilised linguistic assessments to integrate expert judgements. These judgements were subsequently converted to triangular fuzzy numbers and further analysed using the fuzzy TOPSIS computational process.

First, the experts evaluate the criteria and alternatives using the linguistic terms outlined in Table 2 and Table 3, respectively. Table 4 shows the experts' evaluations on the significance of the criteria.

Table 4. The experts' evaluations of the significance of the criteria

	E ₁	E ₂	E ₃	E ₄
C ₁	EI	EI	EI	SI
C ₂	MI	SI	SWI	MI
C ₃	SI	SWI	MI	EI
C ₄	SWI	MI	SI	SWI

Furthermore, the data were gathered from the experts on the performance of alternatives with respect to the criteria that are presented in Table 5.

Table 5. The experts' evaluations on the performance of alternatives with respect to the criteria

	C ₁				C ₂				C ₃				C ₄			
	E ₁	E ₂	E ₃	E ₄	E ₁	E ₂	E ₃	E ₄	E ₁	E ₂	E ₃	E ₄	E ₁	E ₂	E ₃	E ₄
A ₁	SWI	MI	EI	SI	SI	NI	MI	NI	SI	NI	NI	EI	EI	SWI	EI	EI
A ₂	EI	EI	SI	SWI	EI	SI	SI	SWI	MI	NI	NI	SWI	MI	SI	NI	MI
A ₃	SWI	MI	MI	SWI	SI	NI	MI	SWI	SI	NI	SWI	SWI	MI	SI	MI	SWI
A ₄	EI	SWI	EI	EI	MI	NI	SWI	MI	SWI	SWI	EI	EI	EI	EI	SWI	SWI
A ₅	SWI	SI	MI	SWI	SI	NI	MI	MI	MI	SWI	EI	EI	SWI	EI	SWI	SWI
A ₆	EI	MI	EI	SWI	MI	SI	SWI	MI	EI	SWI	EI	EI	EI	EI	EI	EI
A ₇	SWI	MI	SI	SWI	SI	NI	NI	SWI	MI	NI	MI	SWI	SWI	SI	MI	SWI
A ₈	EI	SI	SWI	EI	MI	SI	EI	EI	MI	MI	SWI	SWI	SWI	EI	SWI	SWI
A ₉	SWI	SI	SI	EI	MI	SI	SI	SWI	MI	MI	SI	MI	MI	MI	SI	MI
A ₁₀	EI	SWI	MI	EI	SWI	SI	SI	SWI	SWI	NI	SI	SWI	SWI	SWI	SI	MI
A ₁₁	EI	SI	SI	SWI	SWI	SWI	MI	MI	MI	SI	MI	MI	MI	SWI	SI	MI
A ₁₂	EI	MI	EI	EI	EI	SWI	EI	EI	EI	MI	SWI	EI	SWI	SWI	EI	EI
A ₁₃	EI	EI	EI	SWI	EI	SWI	EI	SWI	SWI	MI	SWI	EI	SWI	EI	EI	SWI
A ₁₄	MI	SI	EI	SI	SI	NI	NI	MI	MI	EI	EI	SWI	SWI	MI	EI	EI
A ₁₅	SWI	SWI	EI	SWI	SWI	SWI	SI	SI	MI	MI	MI	MI	SWI	MI	MI	MI
A ₁₆	MI	MI	MI	MI	MI	MI	SI	MI	MI	SI	MI	SWI	MI	SWI	SI	SWI
A ₁₇	EI	SI	SWI	EI	EI	MI	SWI	SWI	SWI	MI	SWI	SWI	SWI	MI	SWI	SWI
A ₁₈	SWI	SI	MI	NI	MI	SI	MI	MI	SWI	SI	EI	MI	SWI	MI	SI	MI
A ₁₉	SWI	SI	SI	MI	MI	SI	NI	MI	MI	SI	SI	SWI	MI	SI	SI	SWI

These linguistic ratings are converted to fuzzy numbers using Eq. (1) and Eq. (2). The results of these computations are shown in Table 6.

Table 6. The aggregate fuzzy ratings for the level of significance of the criteria

Criteria	Experts				Aggregate Fuzzy Ratings
	E ₁	E ₂	E ₃	E ₄	
C ₁	(7,9,9)	(7,9,9)	(7,9,9)	(1,1,3)	(1,7,9)
C ₂	(1,3,5)	(1,1,3)	(5,7,9)	(1,3,5)	(1,3,5,9)
C ₃	(1,1,3)	(5,7,9)	(1,3,5)	(7,9,9)	(1,5,9)
C ₄	(5,7,9)	(1,3,5)	(1,1,3)	(5,7,9)	(1,4,5,9)

Table 6 shows the aggregate fuzzy ratings for the level of significance of the criteria. The aggregate fuzzy ratings for the performance of the alternatives with respect to Psychological Factor (C₁), Physical Factor (C₂), Social Interaction (C₃), and Seeking/Exploration (C₄) are presented in Table 7, Table 8, Table 9, and Table 10, respectively.

Table 7. The aggregate fuzzy ratings for the performance of the alternatives with respect to the Psychological Factor (C₁)

Alternatives	Experts				Aggregate Fuzzy Ratings
	E ₁	E ₂	E ₃	E ₄	
A ₁	(5,7,9)	(3,5,7)	(7,9,9)	(1,3,5)	(1,6,9)
A ₂	(7,9,9)	(7,9,9)	(1,3,5)	(5,7,9)	(1,7,9)
A ₃	(5,7,9)	(3,5,7)	(3,5,7)	(5,7,9)	(3,6,9)
A ₄	(7,9,9)	(5,7,9)	(7,9,9)	(7,9,9)	(5,8,5,9)

A ₅	(5,7,9)	(1,3,5)	(3,5,7)	(5,7,9)	(1,5,5,9)
A ₆	(7,9,9)	(3,5,7)	(7,9,9)	(5,7,9)	(3,7,5,9)
A ₇	(5,7,9)	(3,5,7)	(1,3,5)	(5,7,9)	(1,5,5,9)
A ₈	(7,9,9)	(1,3,5)	(5,7,9)	(7,9,9)	(1,7,9)
A ₉	(5,7,9)	(1,3,5)	(1,3,5)	(7,9,9)	(1,5,5,9)
A ₁₀	(7,9,9)	(5,7,9)	(3,5,7)	(7,9,9)	(3,7,5,9)
A ₁₁	(7,9,9)	(1,3,5)	(1,3,5)	(5,7,9)	(1,5,5,9)
A ₁₂	(7,9,9)	(3,5,7)	(7,9,9)	(7,9,9)	(3,8,9)
A ₁₃	(7,9,9)	(7,9,9)	(7,9,9)	(5,7,9)	(5,8,5,9)
A ₁₄	(3,5,7)	(1,3,5)	(7,9,9)	(1,3,5)	(1,5,9)
A ₁₅	(5,7,9)	(5,7,9)	(7,9,9)	(5,7,9)	(5,7,5,9)
A ₁₆	(3,5,7)	(3,5,7)	(3,5,7)	(3,5,7)	(3,5,7)
A ₁₇	(7,9,9)	(1,3,5)	(5,7,9)	(7,9,9)	(1,7,9)
A ₁₈	(5,7,9)	(1,3,5)	(3,5,7)	(1,1,3)	(1,4,9)
A ₁₉	(5,7,9)	(1,3,5)	(1,3,5)	(3,5,7)	(1,4,5,9)

Table 8. The aggregate fuzzy ratings for the performance of the alternatives with respect to the Physical Factor (C₂)

Alternatives	Experts				Aggregate Fuzzy Ratings
	E ₁	E ₂	E ₃	E ₄	
A ₁	(1,3,5)	(1,1,3)	(3,5,7)	(1,1,3)	(1,2,5,7)
A ₂	(7,9,9)	(1,3,5)	(1,3,5)	(5,7,9)	(1,5,5,9)
A ₃	(1,3,5)	(1,1,3)	(3,5,7)	(5,7,9)	(1,4,9)
A ₄	(3,5,7)	(1,1,3)	(5,7,9)	(3,5,7)	(1,4,5,9)
A ₅	(1,3,5)	(1,1,3)	(3,5,7)	(3,5,7)	(1,3,5,9)
A ₆	(3,5,7)	(1,3,5)	(5,7,9)	(3,5,7)	(1,5,9)
A ₇	(1,3,5)	(1,1,3)	(1,1,3)	(5,7,9)	(1,3,9)
A ₈	(3,5,7)	(1,3,5)	(7,9,9)	(7,9,9)	(1,6,5,9)
A ₉	(3,5,7)	(1,3,5)	(1,3,5)	(5,7,9)	(1,4,5,9)
A ₁₀	(5,7,9)	(1,3,5)	(1,3,5)	(5,7,9)	(1,5,9)
A ₁₁	(5,7,9)	(5,7,9)	(3,5,7)	(3,5,7)	(3,6,9)
A ₁₂	(7,9,9)	(5,7,9)	(7,9,9)	(7,9,9)	(5,8,5,9)
A ₁₃	(7,9,9)	(5,7,9)	(7,9,9)	(5,7,9)	(5,8,9)
A ₁₄	(1,3,5)	(1,3,5)	(1,1,3)	(1,1,3)	(1,2,5)
A ₁₅	(5,7,9)	(5,7,9)	(1,3,5)	(1,3,5)	(1,5,9)
A ₁₆	(3,5,7)	(3,5,7)	(1,3,5)	(3,5,7)	(1,4,5,7)
A ₁₇	(7,9,9)	(3,5,7)	(5,7,9)	(5,7,9)	(3,7,9)
A ₁₈	(3,5,7)	(1,3,5)	(3,5,7)	(3,5,7)	(1,4,5,7)
A ₁₉	(3,5,7)	(1,3,5)	(1,1,3)	(3,5,7)	(1,3,5,7)

Table 9. The aggregate fuzzy ratings for the performance of the alternatives with respect to the Social Interaction (C₃)

Alternatives	Experts				Aggregate Fuzzy Ratings
	E ₁	E ₂	E ₃	E ₄	
A ₁	(1,3,5)	(1,1,3)	(1,1,3)	(7,9,9)	(1,3.5,9)
A ₂	(3,5,7)	(1,1,3)	(1,1,3)	(5,7,9)	(1,3.5,9)
A ₃	(1,3,5)	(1,1,3)	(5,7,9)	(5,7,9)	(1,4.5,9)
A ₄	(5,7,9)	(5,7,9)	(7,9,9)	(7,9,9)	(5,8,9)
A ₅	(3,5,7)	(5,7,9)	(7,9,9)	(7,9,9)	(3,7.5,9)
A ₆	(7,9,9)	(5,7,9)	(7,9,9)	(7,9,9)	(5,8.5,9)
A ₇	(3,5,7)	(1,1,3)	(3,5,7)	(5,7,9)	(1,4.5,9)
A ₈	(3,5,7)	(3,5,7)	(5,7,9)	(5,7,9)	(3,6,9)
A ₉	(3,5,7)	(3,5,7)	(1,3,5)	(3,5,7)	(1,4.5,7)
A ₁₀	(5,7,9)	(1,1,3)	(1,3,5)	(5,7,9)	(1,4.5,9)
A ₁₁	(3,5,7)	(1,3,5)	(3,5,7)	(3,5,7)	(1,4.5,7)
A ₁₂	(7,9,9)	(3,5,7)	(5,7,9)	(7,9,9)	(3,7.5,9)
A ₁₃	(5,7,9)	(3,5,7)	(5,7,9)	(7,9,9)	(3,7,9)
A ₁₄	(3,5,7)	(3,5,7)	(7,9,9)	(7,9,9)	(3,7,9)
A ₁₅	(3,5,7)	(3,5,7)	(3,5,7)	(3,5,7)	(3,5,7)
A ₁₆	(3,5,7)	(1,3,5)	(3,5,7)	(5,7,9)	(1,5,9)
A ₁₇	(5,7,9)	(3,5,7)	(5,7,9)	(5,7,9)	(3,6.5,9)
A ₁₈	(5,7,9)	(1,3,5)	(7,9,9)	(3,5,7)	(1,6,9)
A ₁₉	(3,5,7)	(1,3,5)	(1,3,5)	(5,7,9)	(1,4.5,9)

Table 10. The aggregate fuzzy ratings for the performance of the alternatives with respect to the Seeking/Exploration (C₄)

Alternatives	Experts				Aggregate Fuzzy Ratings
	E ₁	E ₂	E ₃	E ₄	
A ₁	(7,9,9)	(5,7,9)	(7,9,9)	(7,9,9)	(5,8.5,9)
A ₂	(3,5,7)	(1,3,5)	(1,1,3)	(3,5,7)	(1,3.5,7)
A ₃	(3,5,7)	(1,3,5)	(3,5,7)	(5,7,9)	(1,5,9)
A ₄	(7,9,9)	(7,9,9)	(5,7,9)	(5,7,9)	(5,8,9)
A ₅	(5,7,9)	(7,9,9)	(5,7,9)	(5,7,9)	(5,7.5,9)
A ₆	(7,9,9)	(7,9,9)	(7,9,9)	(7,9,9)	(7,9,9)
A ₇	(5,7,9)	(1,3,5)	(3,5,7)	(5,7,9)	(1,5.5,9)
A ₈	(5,7,9)	(7,9,9)	(5,7,9)	(5,7,9)	(5,7.5,9)
A ₉	(3,5,7)	(3,5,7)	(1,3,5)	(3,5,7)	(1,4.5,7)
A ₁₀	(5,7,9)	(5,7,9)	(1,3,5)	(3,5,7)	(1,5.5,9)
A ₁₁	(3,5,7)	(5,7,9)	(1,3,5)	(3,5,7)	(1,5,9)
A ₁₂	(5,7,9)	(5,7,9)	(7,9,9)	(7,9,9)	(5,8,9)
A ₁₃	(5,7,9)	(7,9,9)	(7,9,9)	(5,7,9)	(5,8,9)
A ₁₄	(5,7,9)	(5,7,9)	(3,5,7)	(7,9,9)	(3,7,9)

A ₁₅	(5,7,9)	(3,5,7)	(3,5,7)	(3,5,7)	(3,5.5,9)
A ₁₆	(3,5,7)	(5,7,9)	(1,3,5)	(5,7,9)	(1,5.5,9)
A ₁₇	(5,7,9)	(3,5,7)	(5,7,9)	(5,7,9)	(3,6.5,9)
A ₁₈	(5,7,9)	(3,5,7)	(1,3,5)	(3,5,7)	(1,5,9)
A ₁₉	(3,5,7)	(1,3,5)	(1,3,5)	(5,7,9)	(1,4.5,9)

The aggregate fuzzy ratings are the combined opinions of multiple experts on the importance or preference of specific criteria. They offer a structured method for summarising expert judgements using fuzzy numbers, allowing for the uncertainty, imprecision, and subjectivity inherent in human evaluations.

Next, the fuzzy decision matrix was constructed by using Eq. (3). It represents the weightage of the criteria's importance (W) and the performance of the alternatives with respect to each criterion (X).

$$W = [(1, 7, 9) \quad (1, 3.5, 9) \quad (1, 5, 9) \quad (1, 4.5, 9)]$$

$$X = \begin{bmatrix} (1, 6, 9) & (1, 2.5, 7) & (1, 3.5, 9) & (5, 8.5, 9) \\ (1, 7, 9) & (1, 5.5, 9) & (1, 3.5, 9) & (1, 3.5, 7) \\ (3, 6, 9) & (1, 4, 9) & (1, 4.5, 9) & (1, 5, 9) \\ (5, 8.5, 9) & (1, 4.5, 9) & (5, 8, 9) & (5, 8, 9) \\ (1, 5.5, 9) & (1, 3.5, 9) & (3, 7.5, 9) & (5, 7.5, 9) \\ (3, 7.5, 9) & (1, 5, 9) & (5, 8.5, 9) & (7, 9, 9) \\ (1, 5.5, 9) & (1, 3, 9) & (1, 4.5, 9) & (1, 5.5, 9) \\ (1, 7, 9) & (1, 6.5, 9) & (3, 6, 9) & (5, 7.5, 9) \\ (1, 5.5, 9) & (1, 4.5, 9) & (1, 4.5, 7) & (1, 4.5, 7) \\ (3, 7.5, 9) & (1, 5, 9) & (1, 4.5, 9) & (1, 5.5, 9) \\ (1, 5.5, 9) & (3, 6, 9) & (1, 4.5, 7) & (1, 5, 9) \\ (3, 8, 9) & (5, 8.5, 9) & (3, 7.5, 9) & (5, 8, 9) \\ (5, 8.5, 9) & (5, 8, 9) & (3, 7, 9) & (5, 8, 9) \\ (1, 5, 9) & (1, 2, 5) & (3, 7, 9) & (3, 7, 9) \\ (5, 7.5, 9) & (1, 5, 9) & (3, 5, 7) & (3, 5.5, 9) \\ (3, 5, 7) & (1, 4.5, 7) & (1, 5, 9) & (1, 5.5, 9) \\ (1, 7, 9) & (3, 7, 9) & (3, 6.5, 9) & (3, 6.5, 9) \\ (1, 4, 9) & (1, 4.5, 7) & (1, 6, 9) & (1, 5, 9) \\ (1, 4.5, 9) & (1, 3.5, 7) & (1, 4.5, 9) & (1, 4.5, 9) \end{bmatrix}$$

The fuzzy decision matrix is necessary because it organises the fuzzy weights and performance scores of alternatives, captures uncertainty in judgements, and serves as a basis for computational steps in fuzzy MCDM methods. It connects expert input and processes for decision-making, ensuring that the results are complete and reliable.

The next step involved developing the normalised decision matrix using Eq. (5). The results of these computations are shown in Table 11.

Table 11. Normalised fuzzy decision matrix

	C ₁	C ₂	C ₃	C ₄
A ₁	(0.1111,0.6667,1)	(0.1111,0.2778,0.7778)	(0.1111,0.3889,1)	(0.5556,0.9444,1)
A ₂	(0.1111,0.7778,1)	(0.1111,0.6111,1)	(0.1111,0.3889,1)	(0.1111,0.3889,0.7778)
A ₃	(0.3333,0.6667,1)	(0.1111,0.4444,1)	(0.1111,0.5,1)	(0.1111,0.5556,1)
A ₄	(0.5556,0.9444,1)	(0.1111,0.5,1)	(0.5556,0.8889,1)	(0.5556,0.8889,1)
A ₅	(0.1111,0.6111,1)	(0.1111,0.3889,0.7778)	(0.3333,0.8333,1)	(0.5556,0.8333,1)
A ₆	(0.3333,0.8333,1)	(0.1111,0.5556,1)	(0.5556,0.9444,1)	(0.7778,1,1)
A ₇	(0.1111,0.6111,1)	(0.1111,0.3333,1)	(0.1111,0.5,1)	(0.1111,0.6111,1)
A ₈	(0.1111,0.7778,1)	(0.1111,0.7222,1)	(0.3333,0.6667,1)	(0.5556,0.8333,1)
A ₉	(0.1111,0.6111,1)	(0.1111,0.5,1)	(0.1111,0.5,0.7778)	(0.1111,0.5,0.7778)
A ₁₀	(0.3333,0.8333,1)	(0.1111,0.5556,1)	(0.1111,0.5,1)	(0.1111,0.6111,1)
A ₁₁	(0.1111,0.6111,1)	(0.3333,0.6667,1)	(0.1111,0.5,0.7778)	(0.1111,0.5556,1)
A ₁₂	(0.3333,0.8889,1)	(0.5556,0.9444,1)	(0.3333,0.8333,1)	(0.5556,0.8889,1)
A ₁₃	(0.5556,0.9444,1)	(0.5556,0.8889,1)	(0.3333,0.7778,1)	(0.5556,0.8889,1)
A ₁₄	(0.1111,0.5556,1)	(0.1111,0.2222,0.5556)	(0.3333,0.7778,1)	(0.3333,0.7778,1)
A ₁₅	(0.5556,0.8333,1)	(0.1111,0.5556,1)	(0.3333,0.5556,0.7778)	(0.3333,0.6111,1)
A ₁₆	(0.3333,0.5556,0.7778)	(0.1111,0.5,0.7778)	(0.1111,0.5556,1)	(0.1111,0.6111,1)
A ₁₇	(0.1111,0.7778,1)	(0.3333,0.7778,1)	(0.3333,0.7222,1)	(0.3333,0.7222,1)
A ₁₈	(0.1111,0.4444,1)	(0.1111,0.5,0.7778)	(0.1111,0.6667,1)	(0.1111,0.5556,1)
A ₁₉	(0.1111,0.5,1)	(0.1111,0.3889,0.7778)	(0.1111,0.5,1)	(0.1111,0.5,1)

The normalised decision matrix ensures fairness, removes bias from varying scales, and allows for meaningful comparisons and calculations. It is a crucial step in ensuring the accuracy and comprehensibility of the decision-making process.

Then, the weighted normalised decision matrix is calculated using Eq. (7), and the outcomes are presented in Table 12.

Table 12. Weighted normalised fuzzy decision matrix

	C ₁	C ₂	C ₃	C ₄
A ₁	(0.1111,4.6667,9)	(0.1111,0.9722,7)	(0.1111,1.9444,9)	(0.5556,4.25,9)
A ₂	(0.1111,5.4444,9)	(0.1111,2.1389,9)	(0.1111,1.9444,9)	(0.1111,1.75,7)
A ₃	(0.3333,4.6667,9)	(0.1111,1.5556,9)	(0.1111,2.5,9)	(0.1111,2.5,9)
A ₄	(0.5556,6.6111,9)	(0.1111,1.75,9)	(0.5556,4.4444,9)	(0.5556,4,9)
A ₅	(0.1111,4.2778,9)	(0.1111,1.3611,7)	(0.3333,4.1667,9)	(0.5556,3.75,9)
A ₆	(0.3333,5.8333,9)	(0.1111,1.9444,9)	(0.5556,4.7222,9)	(0.7778,4.5,9)
A ₇	(0.1111,4.2778,9)	(0.1111,1.1667,9)	(0.1111,2.5,9)	(0.1111,2.75,9)
A ₈	(0.1111,5.4444,9)	(0.1111,2.5278,9)	(0.3333,3.3333,9)	(0.5556,3.75,9)
A ₉	(0.1111,4.2778,9)	(0.1111,1.75,9)	(0.1111,2.5,7)	(0.1111,2.25,7)
A ₁₀	(0.3333,5.8333,9)	(0.1111,1.9444,9)	(0.1111,2.5,9)	(0.1111,2.75,9)
A ₁₁	(0.1111,4.2778,9)	(0.3333,2.3333,9)	(0.1111,2.5,7)	(0.1111,2.5,9)

A ₁₂	(0.3333,6.2222,9)	(0.5556,3.3056,9)	(0.3333,4.1667,9)	(0.5556,4,9)
A ₁₃	(0.5556,6.6111,9)	(0.5556,3.1111,9)	(0.3333,3.8889,9)	(0.5556,4,9)
A ₁₄	(0.1111,3.8889,9)	(0.1111,0.7778,5)	(0.3333,3.8889,9)	(0.3333,3.5,9)
A ₁₅	(0.5556,5.8333,9)	(0.1111,1.9444,9)	(0.3333,2.7778,7)	(0.3333,2.75,9)
A ₁₆	(0.3333,3.8889,7)	(0.1111,1.75,7)	(0.1111,2.7778,9)	(0.1111,2.75,9)
A ₁₇	(0.1111,5.4444,9)	(0.3333,2.7222,9)	(0.3333,3.6111,9)	(0.3333,3.25,9)
A ₁₈	(0.1111,3.1111,9)	(0.1111,1.75,7)	(0.1111,3.3333,9)	(0.1111,2.5,9)
A ₁₉	(0.1111,3.5,9)	(0.1111,1.3611,7)	(0.1111,2.5,9)	(0.1111,2.25,9)

The weighted normalised decision matrix considers the relative significance of criteria during the evaluation process, ensuring that decisions are fair and consistent with real-world priorities. It enhances the consistency, accuracy, and justification of final rankings in MCDM problems.

Following the method proposed by Chen (2000), the FPIS and FNIS were standardised to $(1 \ 1 \ 1)$ and $(0 \ 0 \ 0)$ respectively. Then, Eq. (8) and Eq. (9) were used to calculate the distances between the fuzzy triangular numbers in the weighted normalised decision matrix for each alternative. Table 13 shows the distances between the weighted normalised fuzzy decision matrix for each alternative and FPIS, whereas Table 14 shows the distances between the weighted normalised fuzzy decision matrix for each alternative and FNIS.

Table 13. The distances between the weighted normalised fuzzy decision matrix for each alternative and the FPIS

	C ₁	C ₂	C ₃	C ₄
A ₁	5.1067	3.5019	4.6791	4.9920
A ₂	5.3086	4.6935	4.6791	3.5286
A ₃	5.0954	4.6583	4.7272	4.7272
A ₄	5.6475	4.6674	5.0353	4.9396
A ₅	5.0178	3.5081	4.9824	4.8908
A ₆	5.4100	4.6791	5.1007	5.0431
A ₇	5.0178	4.6482	4.7272	4.7558
A ₈	5.3086	4.7302	4.8266	4.8908
A ₉	5.0178	4.6674	3.6074	3.5755
A ₁₀	5.4100	4.6791	4.7272	4.7558
A ₁₁	5.0178	4.6983	3.6074	4.7272
A ₁₂	5.5292	4.8136	4.9824	4.9396
A ₁₃	5.6475	4.7838	4.9258	4.9396
A ₁₄	4.9375	2.3692	4.9258	4.8544
A ₁₅	5.4024	4.6791	3.6334	4.7437
A ₁₆	3.8639	3.5286	4.7592	4.7558
A ₁₇	5.3086	4.7403	4.8738	4.8134
A ₁₈	4.8044	3.5286	4.8385	4.7272
A ₁₉	4.8662	3.5081	4.7272	4.7029

Table 14. The distances between the weighted normalised fuzzy decision matrix for each alternative and the FNIS

	C ₁	C ₂	C ₃	C ₄
A ₁	5.8535	4.0808	5.3164	5.7553
A ₂	6.0733	5.3413	5.3164	4.1663
A ₃	5.8563	5.2736	5.3933	5.3933
A ₄	6.4554	5.2939	5.8041	5.6953
A ₅	5.7536	4.1176	5.7292	5.6383
A ₆	6.1951	5.3164	5.8767	5.8268
A ₇	5.7536	5.2400	5.3933	5.4337
A ₈	6.0733	5.3976	5.5444	5.6383
A ₉	5.7536	5.2939	4.2919	4.2456
A ₁₀	6.1951	5.3164	5.3933	5.4337
A ₁₁	5.7536	5.3714	4.2919	5.3933
A ₁₂	6.3200	5.5448	5.7292	5.6953
A ₁₃	6.4554	5.5072	5.6638	5.6953
A ₁₄	5.6609	2.9222	5.6638	5.5786
A ₁₅	6.2004	5.3164	4.3523	5.4367
A ₁₆	4.6273	4.1663	5.4384	5.4337
A ₁₇	6.0733	5.4321	5.6021	5.5279
A ₁₈	5.4982	4.1663	5.5415	5.3933
A ₁₉	5.5756	4.1176	5.3933	5.3565

Finding the distance between the FPIS and FNIS for each alternative serves as essential for determining how well it aligns with the "best" and "worst" scenarios. This step ensures that the evaluation is robust, balanced, and objective, taking into consideration the relative importance of all criteria and allowing decision-makers to identify the best alternative.

Next, the total distance of each alternative from the FPIS and the FNIS was calculated using Eq. (10) and Eq. (11). The total distance of each alternative from the FPIS and FNIS is critical for efficiently evaluating, ranking, and selecting the best alternative. This method combines all criteria into a single, meaningful measure that accounts for their relative importance, balances competing goals, and addresses uncertainties. As a result, it guarantees a thorough, dependable, and objective decision-making process. Table 15 presents the total distances of each alternative from the FPIS and FNIS.

Table 15. The total distances of each alternative from the FPIS and FNIS

	d ⁺	d ⁻
A ₁	18.2797	21.0060
A ₂	18.2098	20.8973
A ₃	19.2081	21.9164
A ₄	20.2897	23.2486
A ₅	18.3991	21.2388
A ₆	20.2330	23.2151
A ₇	19.1490	21.8206

A ₈	19.7562	22.6536
A ₉	16.8680	19.5850
A ₁₀	19.5722	22.3385
A ₁₁	18.0507	20.8102
A ₁₂	20.2648	23.2893
A ₁₃	20.2966	23.3216
A ₁₄	17.0868	19.8254
A ₁₅	18.4586	21.3059
A ₁₆	16.9075	19.6657
A ₁₇	19.7361	22.6354
A ₁₈	17.8988	20.5993
A ₁₉	17.8045	20.4430

For each alternative, the closeness coefficient (CC_i) was determined using Eq. (12). Table 16 illustrates the closeness coefficient (CC_i) for each alternative.

Table 16. The closeness coefficient (CC_i) for each alternative

	CC_i
A ₁	0.5347
A ₂	0.5344
A ₃	0.5329
A ₄	0.5340
A ₅	0.5358
A ₆	0.5343
A ₇	0.5326
A ₈	0.5342
A ₉	0.5373
A ₁₀	0.5330
A ₁₁	0.5355
A ₁₂	0.5347
A ₁₃	0.5347
A ₁₄	0.5371
A ₁₅	0.5358
A ₁₆	0.5377
A ₁₇	0.5342
A ₁₈	0.5351
A ₁₉	0.5345

The Closeness Coefficient (CC_i) plays an important part in determining the best alternative during a decision-making process. It makes complex evaluations easier by integrating performance across all criteria, balancing positive and negative aspects, and presenting a clear and objective ranking.

3.2 Aggregate fuzzy ratings of criteria

The aggregate fuzzy ratings evaluated by the experts for each criterion, along with their rankings, are shown in Table 17.

Table 17. The aggregate fuzzy ratings of criteria

	Criteria	Aggregate Fuzzy Rating	Ranking
C ₁	Psychological Factor	(1,7,9)	1
C ₂	Physical Factor	(1,3.5,9)	4
C ₃	Social Interaction	(1,5,9)	2
C ₄	Seeking/Exploration	(1,4.5,9)	3

Based on the results above, the psychological factor is the most significant factor influencing tourists' destination choices in Perlis. The second important factor from the viewpoint of experts is social interaction, and the third factor is seeking/exploration. The least important factor is the physical factor.

3.3 Closeness coefficient and final ranking

Table 18 shows the Closeness Coefficient (*CC*) values and the resulting rankings of tourism destinations in Perlis based on internal motivational factors.

Table 18. Closeness Coefficient and ranking of tourism destinations

	Alternatives	<i>CC_i</i>	Ranking
A ₁	Arked Niaga Padang Besar	0.5347	7
A ₂	Bukit Tok Dun	0.5344	9
A ₃	Galeri 3D Gua Kelam	0.5329	14
A ₄	Kampung Wai	0.5340	12
A ₅	Kangar Street Art	0.5358	4
A ₆	Kampung Warisan Tradisi Nelayan	0.5343	10
A ₇	Muzium Kota Kayang	0.5326	15
A ₈	Superfruits Valley	0.5342	11
A ₉	Taman Anggur Perlis	0.5373	2
A ₁₀	Taman Eko-Rimba Bukit Ayer	0.5330	13
A ₁₁	Taman Rekreasi Tasik Melati	0.5355	5
A ₁₂	Tasik Timah Tasoh	0.5347	7
A ₁₃	Wang Kelian View Point	0.5347	7
A ₁₄	Nat Pokok Getah	0.5371	3
A ₁₅	Bukit Chabang	0.5358	4
A ₁₆	Pasar Terapung JPS Perlis	0.5377	1
A ₁₇	Taman Negeri Perlis	0.5342	11
A ₁₈	Pusat Kecemerlangan Mempelam Harum Manis	0.5351	6
A ₁₉	Taman Ular Dan Reptilia Negeri Perlis	0.5345	8

The results show that Pasar Terapung JPS Perlis is the highest-ranked destination with a CC of 0.5377, demonstrating the most significant alignment with the internal motivational factors. Following closely are Taman Anggur Perlis ($CC = 0.5373$) and Nat Pokok Getah ($CC = 0.5371$), which offer agro-based education and cultural authenticity. In contrast, destinations such as Muzium Kota Kayang and Galeri 3D Gua Kelam received lower scores in CC, which implies that they may not fulfil the internal demands or preferences of most tourists, particularly in terms of psychological experiences.

3.4 Results Interpretation

The ranking findings provide valuable information on the relative performance of tourism destinations, but their true value lies in identifying and highlighting areas that need attention and improvement from local governments and tourism planners. From the perspective of internal motivating factors, lower CC values imply a mismatch between the existing destination offers and the psychological, physical, social interaction, and seeking/exploration demands of visitors rather than a lack of tourism potential.

The top-ranked destinations, such as Pasar Terapung JPS Perlis, Taman Anggur Perlis, and Nat Pokok Getah share several common traits. They are culturally immersive, experiential, and community-based destinations. These attributes align well with the psychological and social interaction criteria, which were identified as the main factors in the fuzzy weight analysis. Pasar Terapung JPS Perlis offers a unique floating market experience similar to those found in Thailand. Located in a shaded rubber tree plantation, Nat Pokok Getah offers a genuine rural market atmosphere rich in local interaction, and Taman Anggur Perlis features an agro-tourism journey that integrates educational value with natural and social enjoyment. These destinations offer relaxation and stress relief, the key components of the psychological factor. Meanwhile, these destinations also promote social connections through interactions with local sellers.

Conversely, Muzium Kota Kayang ranks last among Perlis tourism destinations in terms of internal motivational factors. These results are consistent with previous research (Hsu et al., 2009; Mohamad & Jamil, 2012), which suggests that visitors are increasingly seeking places that meet intrinsic motives, such as personal well-being, social interaction, and novelty. Despite its historical and cultural significance, the museum has struggled to attract a large number of visitors, possibly due to its traditional and less interactive approach. According to a report from Bernama (2018), Muzium Kota Kayang continues to receive fewer visitors compared to other attractions in the region. Experts believe that, while the museum provides valuable insights into Perlis' history and heritage, it lacks the engaging and hands-on activities that many visitors seek. As a result, it ranks lower than destinations offering more dynamic and immersive experiences.

From a psychological perspective, places with low rankings require stronger storytelling, deeper thematic interpretation and more immersive experiences to create memorable and emotionally engaging trips. The use of digital technologies such as virtual reality, multimedia galleries and guided storytelling tours could strengthen tourists' sense of escape and fulfilment. In terms of physical factors, many sites could benefit from enhanced basic and support services, such as shaded rest areas, accessible roads, health and wellness amenities, family-friendly spaces and clear signage. These enhancements are necessary to improve visitors' comfort and enable longer stays. For the social interaction factor, the findings emphasise the need to create places and programs that promote group activities. Cultural events, community-based tourism programs, seasonal events, food festivals and live performances may all help to make individual trips more socially engaged. These initiatives help increase local communities' roles as active stakeholders in tourism. Regarding the seeking/exploration factor, lower-ranked places should include characteristics of novelty and originality. This may be accomplished by diversifying tourist offerings, developing eco-adventure activities, creating thematic trails, promoting nighttime tourism and highlighting local lifestyle experiences. These improvements would improve recurring visitation and draw younger demographics driven by exploration and novel experiences.

Additionally, the gap analysis offers strategic recommendations for state-level infrastructure development. Tourism authorities should adopt a cluster-based plan rather than a uniform development approach, in which neighbouring lower-ranked destinations are developed as complementary attractions, while highly ranked destinations serve as the main tourist centres. Enhancing Perlis's accessibility, transportation connections, and integrated tourism routes would evenly distribute visitor flows.

Overall, the findings provide a useful roadmap for tourism growth by integrating infrastructure design with motivational theory. Local governments could transform undesirable locations into competitive, experience-focused attractions by addressing the specific gaps identified for each motivating feature. This focused strategy guarantees more effective resource allocation and promotes the long-term sustainability of Perlis' tourism industry.

4. CONCLUSION AND RECOMMENDATIONS

This study demonstrated that the fuzzy TOPSIS method successfully evaluated and ranked tourism destinations in Perlis based on internal motivational factors, including psychological factors, physical factors, social interaction, and seeking/exploration. By incorporating and converting expert assessments and linguistic evaluations into fuzzy numbers, fuzzy TOPSIS effectively addresses the inherent complexity and vagueness associated with human judgment in tourism decision-making. The top three ranked places out of nineteen were Nat Pokok Getah, Pasar Terapung JPS Perlis, and Taman Anggur Perlis, reflecting their significant alignment with tourists' intrinsic desires for relaxation and social interaction. At the other end, Muzium Kota Kayang scored lowest, highlighting a need for more engaging and interactive visitor experiences. The results offer valuable information for stakeholders, including tourism planners, travel agencies, and policymakers, to customise marketing strategies, upgrade infrastructure, and enrich visitor experiences. It emphasises the need to integrate tourism development with tourists' intrinsic motivations to ensure sustainable tourism growth in Perlis.

This study focuses solely on internal motivational factors without considering external influences. As a result, future research may concentrate on both internal and external motivational factors to offer a more comprehensive evaluation of tourist preferences. Moreover, researchers are encouraged to apply the fuzzy TOPSIS approach in various states or tourism sectors to compare regional trends and generalise findings. Finally, investigating hybrid approaches that integrate fuzzy TOPSIS with other multi-criteria decision-making techniques may enhance the model's robustness.

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6. CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts, and declare the absence of conflicting interests with the funders.

7. AUTHORS' CONTRIBUTIONS

Teoh Yeong Kin: Supervision, conceptualisation, development of methodology, and formal analysis; **Suzanawati Abu Hasan:** Data interpretation, manuscript writing, and final editing.; **Nor Azriani Mohamad Nor:** Conceptualisation, methodology development, and formal analysis; **Nurul Syafiqah Mohd Suhaimee:** Literature review, data collection, simulation of results, and validation; **Diana Sirmayunie Mohd Nasir:** Language editing and contribution to the interpretation of results.

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