Journal of Applied Research on Industrial Engineering

www.journal-aprie.com

J. Appl. Res. Ind. Eng. Vol. 12, No. 2 (2025) 246–270.

Paper Type: Research Paper

Proposing Appropriate Strategies for Domestic Tourism Promotion in Developing Country by Fuzzy Fermatean MCDM Approach

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Citation:

Received: 20 November 2024 *Revised: 01 February 2025* *Accepted: 04 April 2025*	Bakari, S. J., Bouraima, M. B., Aytekin, A., & Ntow-Gyan, K. (2025). Proposing appropriate strategies for domestic tourism promotion in developing country by fuzzy fermatean MCDM approach. *Journal of applied research on industrial engineering, 12*(2), 246-270.

Abstract

Promoting tourism is essential for the success of any destination. Nevertheless, despite the Tanzanian government's various initiatives to boost the sector, significant challenges remain that obstruct its promotion. This study aims to identify challenges and strategies to promote the tourism sector. We introduce a novel hybrid method called Stepwise Weight Assessment Ratio Analysis (SWARA) method within a Fermatean Fuzzy (FF) environment and Alternative Ranking Order Method Accounting for two-step Normalization (AROMAN). FF-SWARA determines the relative importance of criteria, and AROMAN is employed to rank the strategies. Through sensitivity and comparative analyses, the study validates the effectiveness of this methodology, revealing that the primary obstacles to tourism promotion stem from a lack of domestic tourism development and marketing policy and strategy and the lack of domestic tourism promotion marketing packages. Additionally, the analysis identifies investing in domestic tourism infrastructure and increasing the visibility of tourist attractions and events as the most impactful strategies for overcoming these challenges. This study has significant practical implications for Tanzania's tourism sector by providing a strategic framework to address key challenges hindering domestic tourism growth.

Keywords: Domestic tourism, Fermatean fuzzy, Stepwise weight assessment ratio analysis, Alternative ranking order method accounting for two-step normalization, Tanzania.

1 | Introduction

Tourism has seen remarkable growth globally and is increasingly considered a driver of economic development and entrepreneurial opportunities [1]. This sector plays a crucial role at both global and local

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https://doi.org/10.22105/jarie.2025.489833.1713

levels, significantly contributing to job creation, export revenues, and domestic value addition. It enhances regional attractiveness and quality of life, making areas appealing as travel destinations and places to live, work, and invest. In OECD countries [2], tourism typically accounts for a smaller percentage of GDP, employment, and service exports. Its substantial economic, social, and cultural importance offers genuine prospects for sustainable and inclusive growth.

International tourist arrivals reflect a 3.8% increase from the previous year [3], with OECD countries welcoming over half of these visitors (56.9%) and experiencing faster growth than the global average [4]. In these nations, the spending by international tourists contributes 89% to domestic value-added, significantly boosting local economies, while domestic tourism remains vital, accounting for 75% of total expenditures. However, the COVID-19 pandemic disrupted this momentum, leading to lockdowns and travel restrictions that severely affected global tourism and caused a 20% to 30% decline in international air travel.

There is an increase in growth in the African tourism sector [5], according to the Africa tourist monitor from the African development bank. This rise aligns with global tourism trends, increasing financial inflows to the continent and prompting governments to prioritize tourism in their development strategies. Flexible travel policies, such as e-visas and single visa schemes for Southern African Development Community (SADC) countries [6], have facilitated this growth, with notable initiatives like the KAZA ordinary tourist visa and the East African community's single visa for Kenya, Uganda, and Rwanda [7]. The World Travel and Tourism Council reports that Africa contributes 9.3 million direct tourism jobs, or 2.6% of total employment [3].

Tanzania is classified as a lower-middle-income economy, heavily reliant on agriculture, which employs about half of the workforce [8]. The country has been shifting from a command economy to a market economy, leading to an overall increase in GDP [9]; however, GDP per capita initially fell sharply before recovering to exceed pre-transition levels. Following a recent rebasing, GDP rose by a third to $41.33 billion [10]. Per capita income has grown substantially, from $1,078 in 2018 to $1,121. Despite this increase, local tourism is not keeping pace with international tourism, limiting the impact on domestic travel [10]. Domestic tourism plays a minor role in Tanzania's economy, with only about 1% of the nearly 50 million Tanzanians visiting tourist attractions and less than 1% of a select group climbing Mount Kilimanjaro [10]. Domestic tourism was not a priority until recently, with regulatory frameworks introduced only in the early years. The tourism policy and tourism act establishes licensing and regulations focusing on a high-value, low-volume approach. The tourism regulations, overseen by the Tanzania Tourism Board (TTB), set establishment fees and grading standards. Meanwhile, the Tanzania Tourism Master Plan outlines development goals and encourages diverse pricing options.

Several studies have focused on the tourism sector in Tanzania. For instance, Wamboye et al. [11] analyzed factors influencing international tourism demand in Tanzania from 2000 to 2016, finding that tourist income is the primary determinant. Kitole and Sesabo [12] explored how tourism affects local livelihoods, focusing on the factors influencing livelihood choices and community participation in tourism activities. Tiwari et al. [13] studied and investigated the impact of Tanzania's tourism classification system on the national economy. Kilungu [14] gathered significant research on climate change and tourism, pointing out existing research gaps. This study provides a basis for future inquiry and informs policymakers on tourism development in areas with limited data. Suleiman [15] investigated how purchasing affects sustainable performance in sub-Saharan Africa, using structural equation modeling on data from 167 tourism firms in Tanzania collected in mid-2020. Amani [16] examined how political leaders shape residents to consider residents' roles in inclusive destination branding. Amani [17] employed a resident-centered approach to establish a research model.

Previous studies largely overlooked the challenges affecting Tanzania's tourism sector, except Bakari [10], who acknowledged these issues and underscored the country's potential as a prime tourist destination. However, his research did not prioritize the most pressing challenges or propose concrete solutions. Moreover, earlier studies predominantly relied on qualitative analyses or literature reviews, failing to incorporate Multi Criteria Decision-Making (MCDM) techniques, leaving a significant research gap. To bridge this gap, our study adopts an MCDM approach, moving beyond traditional methods that are less effective in providing structured and data-driven insights [18]-[31].

1.1 | Objectives

This study explores and evaluates the challenges to Tanzanian tourism promotion while proposing strategies to address them. A novel hybrid approach will be employed to achieve this, integrating the Stepwise Weight Assessment Ratio Analysis (SWARA) method within an FF framework alongside the Alternative Ranking Order Method Accounting for two-step Normalization (AROMAN) technique. This combined approach is being applied for the first time, driven by the need to identify the most effective strategy for Tanzanian tourism promotion through the assignment of varying weights to different criteria.

1.2 | Motivations of Using Fermatean Fuzzy-Stepwise Weight Assessment Ratio Analysis- Alternative Ranking Order Method Accounting for Two-Step Normalization Methodology

Fuzzy Fermatean Sets (FFSs) offer an advanced solution for managing uncertain and imprecise data, outperforming intuitionistic and pythagorean fuzzy sets [32]. They effectively resolve conflicting decisions and capture complex human preferences [33]. While FFS-based models have been applied in areas like machine learning [34], urban development [35], earthquake response strategies [36], transportation issues [37], [38] COVID-19 vaccine selection [39], construction [40], [41], transport planning [42], solar energy [43], pandemic strategies [44], they have not yet been used to address challenges in Tanzanian tourism promotion. This study addresses this gap by employing the FFS-based SWARA method to identify and assess these challenges within Tanzania's tourism sector.

Criteria weighting methods rely on decision-makers to prioritize factors [45]. The Analytical Hierarchy Process (AHP) [46] uses pairwise comparisons with numerical values (1–9) to determine relative importance. The Level Based Weight Assessment (LBWA) simplifies comparisons, making it ideal for complex models [47]–[49]. The FUll Consistency Method (FUCOM) enhances consistency by reducing redundancy but lacks extensive validation. The Best-Worst Method (BWM) improves reliability with fewer comparisons but struggles with complex models [50], [51]. Meanwhile, the SWARA method prioritizes the most critical criteria, ignoring less significant ones [52]. For instance, Ghasemian et al. [53] examined challenges in organizational transformation and ranked them based on significance. Mohamed et al. [54] introduced a strategic framework for choosing intelligent and efficient logistics enterprises. Chusi et al. [55] explored Africa's potential in carbon credit trading. Ajalli et al. [56] identified crucial performance metrics for assessing efficiency in humanitarian logistics. Due to its effectiveness, this study adopts the SWARA method for subjective criteria weighting.

Data normalization converts decision-making data into a standardized 0–1 scale, ensuring consistency for effective comparison [57], [58]. Most MCDM methods rely on a single normalization approach, which can lead to biased results. The AROMAN method overcomes this by integrating two techniques—linear and vector normalization—into an averaged decision matrix, enhancing accuracy and reducing subjectivity [59]. Linear normalization adjusts values based on proximity to the best or worst alternative, while vector normalization, also used in TOPSIS, ensures computational efficiency [59]. Research comparing various normalization methods (e.g., min-max, vector, and logarithmic) revealed significant ranking differences, emphasizing the need for a more balanced approach [59]. To address this, Bošković et al. [60] developed AROMAN, which combines these techniques through arithmetic means for more precise normalization. Unlike conventional MCDM methods such as TOPSIS, ARAS, and WASPAS, AROMAN stands out by 1) incorporating both quantitative and qualitative evaluations, 2) enhancing precision through dual normalization, 3) simplifying ranking calculations, and 4) clearly differentiating cost and benefit criteria [59], [61].

1.3 | Contributions of the Study

This paper offers several significant contributions:

I. Introducing an integrated MCDM approach that enriches research on prioritizing national tourism promotion strategies.

II. Highlighting critical challenges hindering tourism growth in Tanzania and offering strategic solutions for policymakers and industry professionals.

III. This showcases the versatility of this methodology and encourages researchers to apply it to solve complex MCDM problems across various sectors in developing countries.

IV. Providing a practical decision-support tool to help policymakers and tourism stakeholders make well-informed choices for advancing tourism promotion in Tanzania.

This paper is organized into nine sections.

2 | Literature Review

2.1 | Overview of Approaches Related to the Tourism Sector

Extensive research on the tourism sector has been conducted worldwide. For instance, Buhalis et al. [62] envisioned the Metaverse as a game-changer for tourism experiences, able to reshape tourism management and marketing. Aguinis et al. [63] reviewed articles from leading journals between 2012 and 2021 to highlight that market failure is the main reason for tourism and hospitality policies primarily aiming to create incentives. Gursoy et al. [64] analyzed the advantages and potential issues posed by Generative Pre-trained Transformers (GPTs). Peeters et al. [65] analyzed climate change mitigation in sustainable tourism literature, finding that data gaps, vague definitions, and narrow boundaries hinder assessing tourism's impact. Miller and Torres-Delgado [66] raised the need to measure sustainable tourism, cautioning that an overemphasis on metrics might divert attention from essential sustainability issues. Bianchi and Milano [67] question traditional views of tourism crises and their underlying structural causes. Dube et al. [68] assessed the progress of tourism research in Africa. Xuanming et al. [69] studied the effects of tourism in African countries. Tourism positively influences the human development index, indicating improved social welfare. Mutanga et al. [70] investigated natural heritage tourism. Adeniyi et al. [71] analyze the link between tourism and income inequality. Ghaforiyan et al. [72] prioritized tourism strategies for Mazandaran's western region. Pourmorshed et al. [73] designed a business model for eco-tourism lodgings. Kordsofla and Sorourkhah [74] examined strategic decision-making amid uncertainty. Heidari Haratemeh and Ebrahimi [75] studied exchange rate volatility's impact on Iran's tourism sector. Niki and Shirouyehzad [76] proposed a framework for ranking European tourism practices. Tian, Liu, and Jiang [77] analyzed customer-driven pricing in Hainan's travel agencies. Abdinematabad et al. [78] explored foreign perceptions of Qingdao's tourism growth. Asadi-Lari et al. [79] addressed hotel revenue and transport cost challenges. Ghasemi and Mohtadi [80] assessed quality factors in Rahyan Noor camps. Imran and Ali [81] linked tourism to Pakistan's economic growth. Uluçay and Okumuş [82] introduced a strategy for sustainable tourism in Turkey. Chu and Liu [83] evaluated how corporate values shape hotel service quality.

2.2 | Application of Multi Criteria Decision-Making Approaches to the Tourism Sector

In hospitality and tourism, stakeholders often face diverse decision-making scenarios where MCDM methods are commonly utilized [84]. For instance, Liu et al. [85] introduced a tailored approach to travel product design, incorporating tourist expectations and feedback from online reviews. Xu et al. [86] explored the ecological viability of mountain lodges, which play a vital role in facilitating tourism services in mountainous regions. Jena and Dwivedi [87] investigated and ranked the obstacles hindering tourism development in Indian rural areas. Maracajá et al. [88] assessed wineries to enhance tourists' choices. Ayvaz-Çavdaroğlu et al. [89]

developed an extended SERVQUAL framework featuring smart service quality. They applied the BWM to assess its dimensions' importance and used latent class clustering to reveal differences among consumer groups. Kang et al. [90] addressed tourism risks and public health safety by proposing sustainable policies that may help mitigate risks in unforeseen situations, offering significant benefits for the future. Lin et al. [91] developed a method that merges an Input-Output (IO) tourism model in Hainan. Liu et al. [92] employed an integrated MCDM approach to offer strategies for improving long-term performance. Alptekin and Büyüközkan [93] created a web-based framework for travel agencies that provide quick, cost-effective customer responses, demonstrating its decision support capabilities through a case study.

3 | Fermatean Fuzzy Stepwise Weight Assessment Ratio Analysis-Alternative Ranking Order Method Accounting for Two-Step Normalization Methodology

Senapati and Yager [32] defined the FFS, which provides a more generic and flexible mechanism for uncertainty assessment. The preliminaries of FFS [94], [95] are indicated in the Appendix.

The SWARA method allows experts to freely assess the importance of subjective criteria without preset standards [96]. It aids in resolving conflicts and supports sound decision-making by assigning weights based on expert input [94], [97]. Unlike AHP, SWARA avoids pairwise comparisons, making it simpler, more stable, and less complex. This method is especially effective for determining criteria weights in a Fermatean Fuzzy (FF) environment.

The AROMAN method is a decision-making tool. It uses a two-phase normalization procedure. By incorporating the importance and weights of criteria, AROMAN provides a detailed ranking of alternatives [98].

The FF-SWARA-AROMAN method evaluates alternatives by determining criteria weights and ranking alternative strategies. This method involves 14 steps [94], [99]. Each phase is indicated in the Appendix.

4 | Application

Our investigation highlights challenges related to domestic tourism promotion in Tanzania and explores strategies to address them by synthesizing previous studies [10], [100]–[104] and consulting experts. To ensure a reliable assessment, we interviewed four experts selected because each of them has over a decade of expertise in the tourism sector and a minimum bachelor's degree at the educational level. The flow chart of our study is shown in *Fig. 1*. The data analysis process is done in three stages. Firstly, the data collection process includes distributing Excel files related to filling the criteria and alternatives. For that, linguistic terms in *Table A1* in the appendix are used to evaluate the requirements, and nine linguistic terms (EL-1, VL-2, L-3, ML-4, M-5, MH-6, H-7, VH-8, EH-9) are used to evaluate the alternatives as can be seen in *Table A3* in Appendix. Then, the FF-SWARA approach is applied to weigh the criteria, and finally, the AROMAN approach is used to rank alternatives.

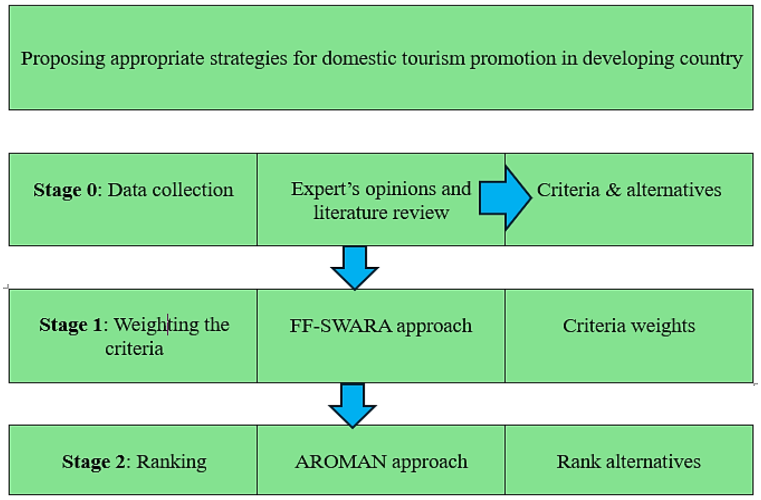

Fig. 1. Flowchart of our study.

4.1 | Challenges and Alternatives Definition

Table A2 defines each challenge and the alternative based on literature review and expert opinions.

4.2 | Criteria Weighting

Step 1. Expert opinions are initially gathered using an Excel sheet using FF-SWARA linguistic terms outlined in *Table A1* and converted into a decision matrix. Experts evaluate the criteria based on their knowledge and experience, with the consolidated assessments summarized in *Table 1*.

Table 1. Criteria evaluations by each expert.

Main Criteria	E1	E2	E3	E4
C1	I	I	I	V
C2	I	I	M	M
C3	V	E	V	V
C4	E	I	I	V
C5	E	E	E	V

Step 2. The FFN is derived by converting linguistic terms with the aggregated expert evaluations in *Table 2*. In this study, experts' evaluations were given equal weight.

The example of *Step 2* calculation for criteria C1 is as follows:

$$= (0.7)^{0.25} \times (0.7)^{0.25} \times (0.7)^{0.25} \times (0.85)^{0.25}$$

$$= 0.809$$

$$= (1\text{-}(((1\text{-}(0.35^{3}))^{0.25}) \times ((1\text{-}(0.35^{0.3}))^{0.25}) \times ((1\text{-}(0.35^{0.3}))^{0.25}) \times ((1\text{-}(0.2^{0.3}))^{0.25})))^{1/3}$$

$$= 0.325$$

Table 2. Aggregated criteria assessment.

Main Criteria	μ	v
C1	0.809	0.325
C2	0.729	0.439
C3	0.916	0.184
C4	0.879	0.288
C5	0.948	0.140

Steps 3. Criteria scores have been determined using the aggregated evaluations in *Table 3*.

The example of *Steps 3* calculation for criteria C1 follows.

$$= 1 + (0.8093)\ - (0.3253)$$

$$= 1.496$$

$$= 1.656 - 1.496$$

$$= \ 0.160$$

$$= 0.160 + 1$$

$$= 1.160$$

$$= \ 0.831/1.160$$

$$= 0.717$$

$$= 0.717/\ (1 + 0.921 + 0.831 + 0.717 + 0.601)$$

$$= 0.1761$$

Table 3. Results of the criteria weighting.

Main Criteria	Scores	c_j	k_j	q_j	Weights
C5	1.850		1	1	0.2457
C3	1.763	0.086	1.086	0.921	0.2262
C4	1.656	0.107	1.107	0.831	0.2043
C1	1.496	0.160	1.160	0.717	0.1761
C2	1.303	0.193	1.193	0.601	0.1477

Table 3 highlights that the primary challenge in promoting tourism in Tanzania is the fifth challenge (C5), identified by experts as a significant concern. The subsequent difficulties ranked second to fifth are C3, C4, C1, and C2, respectively.

4.3 | Ranking the Strategies to Overcome the Challenges to Tourism Promotion

Step 4. Using a scoring scale, the strategies are evaluated against predefined criteria. *Table 4* indicates the initial decision matrix. The value of 5.5 of strategy S1 is obtained by averaging the values of the four experts' evaluations.

$$= 3 + 7 + 5 + 7$$

$$= \ 5.5$$

The same procedure for calculation is done for other strategies.

Table 4. Initial decision-making matrix.

	C1	C2	C3	C4	C5
S1	5.50	4.25	5.25	4.50	6.50
S2	5.00	5.50	5.00	5.00	7.00
S3	5.75	3.75	4.50	6.50	5.50
S4	5.25	5.25	5.25	6.75	7.00
S5	5.50	6.25	6.25	5.00	7.00
Min	5.00	3.75	4.50	4.50	5.50
Max	5.75	6.25	6.25	6.75	7.00

Step 5. The normalization of the data is shown through *Tables 5-7*.

The calculation for strategy S1 and first criteria C1 is as follows for linear normalization.

$$= (5.5 - 5)/\ (5.75 - 5)$$

$$= 0.5/0.75$$

$$= 0.6667$$

Table 5. Linear normalization.

	C1	C2	C3	C4	C5
S1	0.66	0.20	0.42	0.00	0.66
S2	0.00	0.70	0.28	0.22	1.00
S3	1.00	0.00	0.00	0.88	0.00
S4	0.33	0.60	0.42	1.00	1.00
S5	0.66	1.00	1.00	0.22	1.00

The calculation for strategy 1 and first criteria C1 is as follows for vector normalization.

$$= 5.5/\ (\text{SQRT}\ (\text{SUMSQ}\ ((5.5 + 5 + 5.75 + 5.25 + 5.5))$$

$$= 5.5/12.088$$

$$= 0.4550$$

Table 6. Vector normalization of the initial decision-making matrix.

	C1	C2	C3	C4	C5
S1	0.4550	0.3742	0.4446	0.3579	0.4387
S2	0.4136	0.4842	0.4234	0.3977	0.4725
S3	0.4757	0.3302	0.3811	0.5170	0.3712
S4	0.4343	0.4622	0.4446	0.5369	0.4725
S5	0.4550	0.5503	0.5293	0.3977	0.4725

For $\beta = 0.5$, the calculation for strategy 1 and first criteria C1 is as follows:

$$= (0.5 \times 0.6667)\ + ((1 - 0.5)\ \times 0.4550$$

$$= 0.33335 + 0.5 \times 0.4550$$

$$= 0.5608$$

Table 7. Aggregate average normalization (β= 0.5).

	C1	C2	C3	C4	C5
S1	0.56	0.28	0.43	0.17	0.55
S2	0.20	0.59	0.35	0.31	0.73
S3	0.73	0.16	0.19	0.70	0.18
S4	0.38	0.53	0.43	0.76	0.73
S5	0.56	0.77	0.76	0.31	0.73

Table 8 indicates the aggregation weight normalized matrix for different strategies.

The calculation for strategy 1 and first criteria C1 is as follows:

$$= 0.1761\ \times\ 0.5608, \text{with weight of criteria C1}$$

$$= 0.1761$$

$$= 0.0988$$

Table 8. Aggregated average weighted value for strategies.

	C1	C2	C3	C4	C5
S1	0.0988	0.0424	0.0987	0.0366	0.1358
S2	0.0364	0.0874	0.0802	0.0633	0.1809
S3	0.1300	0.0244	0.0431	0.1436	0.0456
S4	0.0676	0.0784	0.0987	0.1570	0.1809
S5	0.0988	0.1145	0.1730	0.0633	0.1809

With $\lambda = 0.5$, L_i and A_i values are computed, ranking strategies as follows:

S3 > S1 > S4 > S5 > S2 and indicated in *Fig. 2* and *Table 9*.

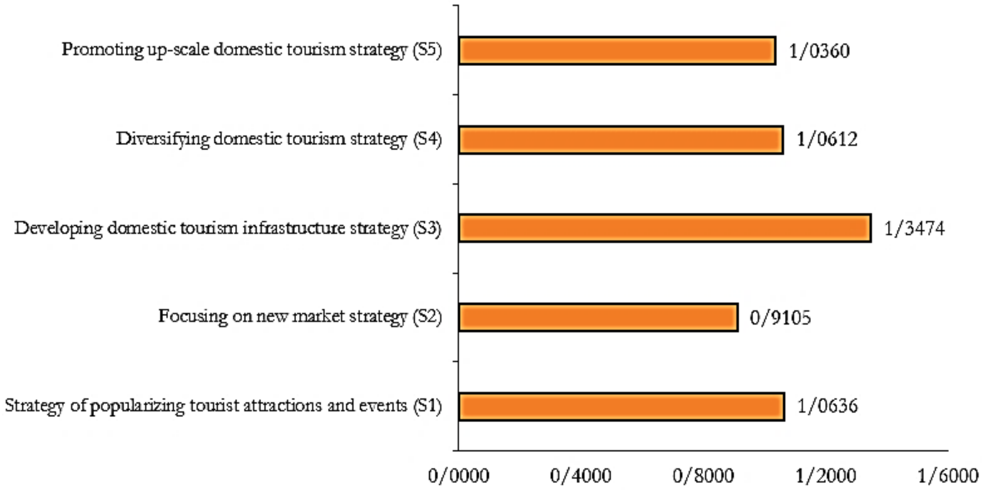

Fig. 2. Final rank of alternatives.

The calculation of L_i and A_i values, differences, and final rank of S1 is as follows:

$$= (0.0424 + 0.1358)\ \hat{}0.5$$

$$= 0.4221$$

$$= (0.0988 + 0.0987 + 0.0366)\ \hat{}0.5$$

$$= 0.4838$$

$$= \text{EXP}\ (0.4838 - 0.4221)$$

$$= 1.0636$$

Table 9. L_i and A_i values, differences, and final rank.

Options	L_i	A_i	A_i-L_i	Rank
S1	0.4221	0.4838	0.0617	1.0636
S2	0.5180	0.4242	0.0938	0.9105
S3	0.2645	0.5627	0.2982	1.3474
S4	0.5092	0.5686	0.0594	1.0612
S5	0.5435	0.5788	0.0354	1.0360

5 | Sensitivity Analysis

The sensitivity analysis has two stages. The first examines the effect of variations in criteria weights, while the second involves incrementally adjusting the threshold value.

5.1 | Criteria Weighting Variation

An approach combining the two procedures was employed to investigate the effects of modifying the criteria weights. First, the criterion's weight was moved to a different criterion in each scenario [95]. For the five criteria, four scenarios were thus created. Second, each criterion's weight coefficient was added to the weight coefficients of the other criteria after being progressively decreased by 10%, beginning with C1 [105]. Thus, 54 scenarios were created, each satisfying the condition that the sum of the criteria weight coefficients equals 1. These scenarios showing the criteria weight coefficients are presented in *Table A4* in the appendix. *Fig. 3* displays the results of these 54 scenarios and the basis conclusions of the study referred to as T0. This approach shows holistically whether the proposed methodology can handle the criteria weights and how it is affected by the criteria weight changes [105], [106].

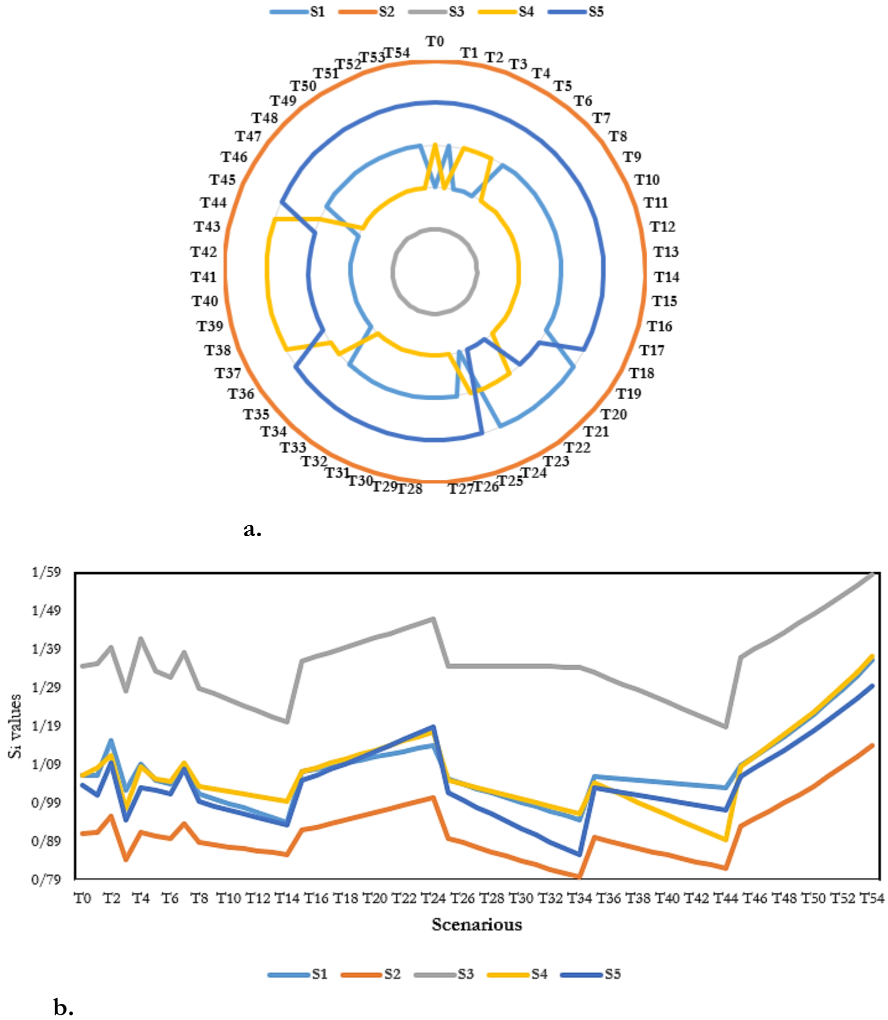

Fig. 3. a. Ranking orders of options in different scenarios, and b. Ranking values of options in different scenarios.

The sensitivity analysis revealed a high correlation between the S_i values obtained for the analyzed problem and those for scenarios ($r \geq 0.9$). The ranking findings of the sensitivity examination showed a robust correlation between the solved problem's results and those of other situations, excluding T19-T24 ($r_s \geq 0.9$). Also, the solved problem's results have an almost high correlation with the results of T19-T24 scenarios. The results in *Fig. 3* show that the approach employed in the study accurately represents the impact of the criterion weight coefficients on the problem solution ($r_s \geq 0.6$). It was also found that the first option retained its position in every scenario. In this context, the approach employed in the study yielded consistent and reflective findings.

5.2 | Sensitivity Analysis Concerning Threshold Value Variation

A threshold value variation from 0 to 1 is used to check the sensitivity analysis in *Table 10*.

Table 10. Sensitivity analysis outcomes.

	S1	S2	S3	S4	S5
0.0	0.50	0.44	0.51	0.50	0.46
0.1	0.59	0.51	0.66	0.59	0.56
0.2	0.69	0.59	0.82	0.69	0.67
0.3	0.80	0.68	0.99	0.79	0.79
0.4	0.92	0.79	1.16	0.92	0.90
0.5	1.06	0.91	1.34	1.06	1.03
0.6	1.22	1.05	1.53	1.21	1.17
0.7	1.41	1.22	1.73	1.38	1.34
0.8	1.64	1.43	1.96	1.58	1.53
0.9	1.92	1.18	2.22	1.75	1.70
1.0	2.27	2.02	2.53	2.09	2.07

There is consistency regarding the ranking no matter what the λ value is, which indicates the procedure's robustness even if it is less affected by variations in the weighting parameter. Such resilience is essential for maintaining the reliability of the decision-making framework. *Fig. 4* presents a graphical depiction of these rankings, clearly demonstrating how alternatives are in their position no matter what the λ values are.

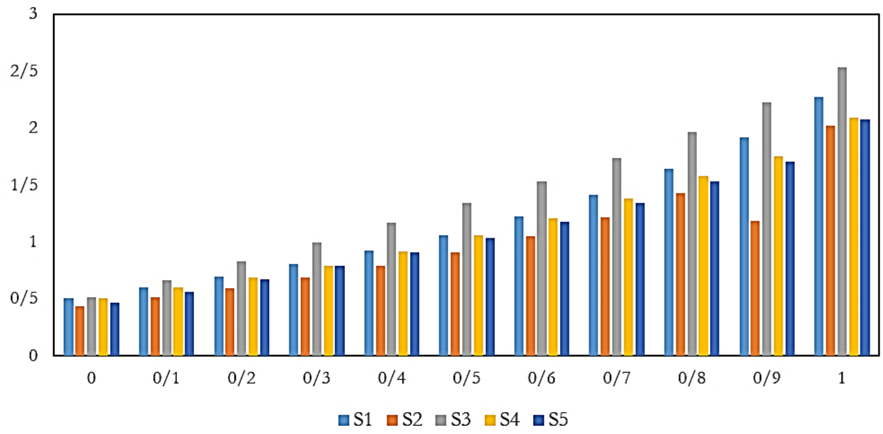

Fig. 4. Sensitivity analysis outcomes based on alternatives.

6 | Comparative Analysis

To assess the effectiveness of our approach, various alternative strategies for domestic tourism promotion were analyzed using the MARCOS [107] and the ARAS [108] approaches. Both methods produced identical rankings for the proposed strategies for domestic tourism promotion (*Fig. 5*): developing domestic tourism infrastructure strategy (S3)> strategy of popularizing tourist attractions and events (S1) > diversifying domestic tourism strategy (S4)> promoting up-scale domestic tourism strategy (S5) > focusing on new market strategy (S2). These consistent results reinforce the reliability of the proposed approach.

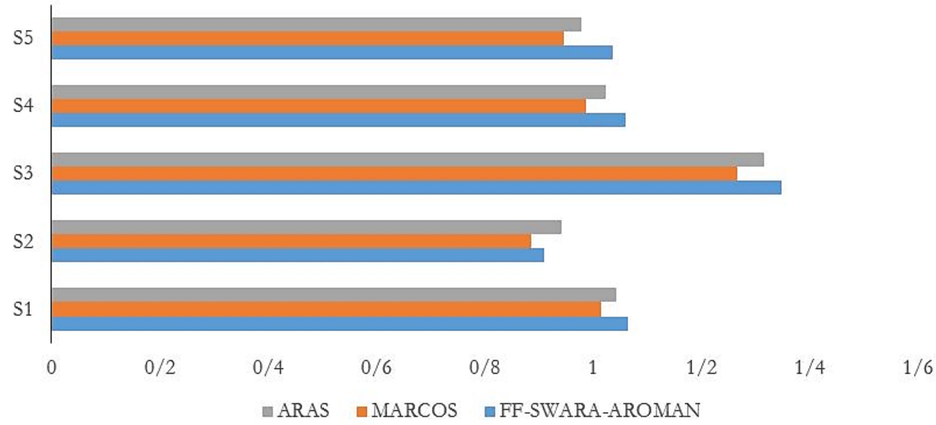

Fig. 5. Comparative analysis with the MARCOS and ARAS approaches.

7 | Findings and Discussion

Experts agree that the absence of domestic tourism development and marketing policy and strategy (C5) is a critical challenge for promoting tourism in Tanzania. Mato and Mosoma [109] emphasized that without a clear policy, there is no cohesive strategy, resulting in fragmented initiatives that fail to engage potential tourists effectively. This lack of direction leads to underutilized resources, as a defined policy could better allocate them. Additionally, without a strategic focus on infrastructure improvements, current facilities may not meet local travelers' needs, discouraging exploration of domestic attractions. Limited awareness of local options further hampers tourism, as effective marketing is crucial for highlighting available opportunities. Economic barriers persist without policies addressing affordability and accessibility, making travel difficult for many. Moreover, neglecting cultural and ecological tourism restricts the attraction of diverse visitors, while lost economic opportunities hinder local economic growth and job creation. Ultimately, without a strategic framework, Tanzania struggles to compete with other destinations that have developed their domestic tourism sectors, negatively affecting its visibility and appeal as a tourist destination.

The lack of domestic tourism promotion marketing packages (C3) stands as the second most critical barrier to tourism promotion, as supported by the study of Charles [110]. Many attractions go unnoticed without well-crafted packages, limiting awareness and discouraging local travel. These packages simplify planning by bundling transport, accommodation, and activities, making trips more accessible; without them, potential tourists may struggle to find options. Tailored marketing could engage diverse demographics, but the lack of such efforts risks excluding significant groups from the market. Additionally, inconsistent messaging can confuse potential visitors, weakening the overall brand. Economic barriers are heightened without discounted packages, making travel unaffordable for many. Attractions may remain underutilized, and events can fail to attract audiences without targeted promotion. Finally, the lack of a structured approach limits stakeholder collaboration, resulting in a fragmented tourism experience. Overall, the lack of effective marketing packages stifles the growth of domestic tourism, undermining its potential contribution to local economies and communities.

This methodology addresses the key challenges to promoting tourism in Tanzania by focusing on two potential strategies. The first strategy involves developing a domestic tourism infrastructure strategy (S3) to ensure that accessibility is improved and accommodation options are diversified. Investing in essential amenities like restaurants, information centers, and sanitation facilities at tourist sites greatly enhances the visitor experience, encouraging local travel [11]. The strategy can promote lesser-known attractions, support eco-tourism and cultural initiatives, and strengthen regional transportation connectivity. Collaborating with the private sector can foster innovative projects while sustainable practices ensure long-term viability. Ultimately, this infrastructure development boosts local economies, creates jobs, and lays the foundation for effective marketing efforts to attract domestic tourists. The second strategy emphasizes popularizing tourist attractions and events (S1), which can significantly enhance the tourism sector by increasing awareness among local and international travelers, thereby attracting diverse visitors. Targeting various demographics broadens the market and encourages repeat visits, which boosts local economies through higher spending on hotels, restaurants, and services.

Additionally, promoting cultural events fosters cultural exchange and appreciation for Tanzania's heritage. Social media and digital marketing can generate organic interest, while stakeholder collaboration ensures effective marketing campaigns. By highlighting attractions year-round, the strategy helps distribute tourist traffic more evenly and can lead to investments in infrastructure. Ultimately, this cohesive approach builds a strong national tourism brand, positioning Tanzania as a premier travel destination and supporting sustained growth in the industry.

8 | Conclusion

The study provides a novel hybrid approach to pinpointing the challenges to promoting the tourism sector in Tanzania and identifying the most appropriate strategies to tackle them. This hybrid approach offers reduced uncertainty and streamlined calculations compared to other methods. A key benefit is the dual application of normalization techniques for dataset processing and strategy ranking. However, the approach is constrained by using only vectorial and linear normalization methods. To further refine the methodology, exploring additional normalization techniques could provide broader flexibility and improved outcomes.

This study offers several significant contributions:

I. Introducing an integrated MCDM approach that enriches research on prioritizing national tourism promotion strategies.

II. Highlighting critical challenges hindering tourism growth in Tanzania and offering strategic solutions for policymakers and industry professionals.

III. This showcases the versatility of this methodology and encourages researchers to apply it to solve complex MCDM problems across various sectors in developing countries.

IV. Providing a practical decision-support tool to help policymakers and tourism stakeholders make well-informed choices for advancing tourism promotion in Tanzania.

Although this study makes significant contributions, it has some limitations. It lacks group decision-making techniques, limiting transparency and collective insights. Its findings may not apply to other African nations, requiring broader validation. The expert sample was small, impacting accuracy. Additionally, the ranking method struggles with uncertainty. Future research should integrate group decision methods, expand expert input, and explore a FF AROMAN approach for better decision-making under uncertainty.

Author Contribution

Conceptualization, S. J. B., and M. B. B; Methodology, M. B. B, and A. A; Software, M. B. B, and A. A; Validation, S. J. B. and A. A; Formal analysis, S. J. B., and A.A; Investigation, A. A and K. N. G; Resources, K. N. G; Data maintenance, K. N. G; Writing-creating the initial design, A. A; Writing-reviewing and editing, S. J. B. and M. B. B; Visualization, A. A; Monitoring, K. N. G; Project management, A. A; Funding procurement, S. J. B. All authors have read and agreed to the published version of the manuscript.

Funding

This research received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data Availability

The data supporting this study's findings are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflict of interest.

References

[1] Li, K. X., Jin, M., & Shi, W. (2018). Tourism as an important impetus to promoting economic growth: A critical review. *Tourism management perspectives*, *26*, 135–142. https://doi.org/10.1016/j.tmp.2017.10.002

[2] Küçüksakarya, S., & Özer, M. (2021). The relationship between economic activity, tourism expenditures and real exchange rate in 9 most visited OECD countries. *Yaşar üniversitesi e-dergisi*, *16*(63), 1535–1550. https://doi.org/10.19168/jyasar.952435

[3] Teperek, A., & Lima Santos, L. (2023). Tourism as an indicator of integration with the world economy: The case of the world's 93 smallest economies generating 1% of global GDP. *Advances in tourism, technology and systems* (pp. 449–464). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-19-9960-4_39

[4] Scott, N., & Marzano, G. (2015). Governance of tourism in OECD countries. *Tourism recreation research*, *40*(2), 181–193. https://doi.org/10.1080/02508281.2015.1041746

[5] Adeniyi, O., Kumeka, T. T., Orekoya, S., & Adekunle, W. (2023). Impact of tourism development on inclusive growth: A panel vector autoregression analysis for African economies. *Tourism economics*, *29*(3), 612–642. https://doi.org/10.1177/13548166211061154

[6] Samunderu, E. (2023). Tourism development in sub-sahara Africa and impact on regional airline business models. In *African air transport management: Strategic analysis of african aviation market* (pp. 189–235). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-29324-5_6

[7] Chihwai, P. (2024). Exploring COVID-19 tourism recovery strategies in East Africa. In *COVID-19 impact on tourism performance in Africa* (pp. 259–275). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-97-1931-0_13

[8] Turuka, F. M. (2022). Tanzania middle income country status and implications for future economic growth strategies. *Tanzania journal of agricultural sciences*, *21*(1), 335–343. https://www.ajol.info/index.php/tjags/article/view/234455

[9] Allen, R., Xixiang, S., & Kilango, N. C. (2017). The role of marketing in economic development in Africa-Tanzania. *European journal of business and management*, *9*(5), 55–60. https://core.ac.uk/download/pdf/234627736.pdf

[10] Bakari, S. (2021). Challenges facing domestic tourism promotion-a case of serengeti national park-Tanzania. *Journal of tourism and hospitality*, *10*(3), 1–16. http://dx.doi.org/10.13140/RG.2.2.17101.15848

[11] Wamboye, E. F., Nyaronga, P. J., & Sergi, B. S. (2020). What are the determinants of international tourism in Tanzania? *World development perspectives*, *17*, 100175. https://doi.org/10.1016/j.wdp.2020.100175

[12] Kitole, F. A., & Sesabo, J. K. (2024). Tourism-driven livelihood dynamics: A comprehensive empirical study of mount Kilimanjaro national park communities in Tanzania. *International journal of geoheritage and parks*, *12*(3), 416–433. https://doi.org/10.1016/j.ijgeop.2024.07.001

[13] Tiwari, R. G., Maheshwari, H., Srivastava, V., Srivastava, M., & Agarwal, A. K. (2023). Assessing the impact of tanzania tourism classification on the economy: A study on the implementation and effectiveness of tourism grading system in tanzania. *2023 3rd international conference on technological advancements in computational sciences (ICTACS)* (pp. 1211–1216). IEEE. https://doi.org/10.1109/ICTACS59847.2023.10389859

[14] Kilungu, H. (2023). A decade of climate change and tourism research in Tanzania: Where are we? *Tanzania journal of forestry and nature conservation*, *92*(1), 185–201. https://doi.org/10.1108/MEQ-01-2022-0007

[15] Suleiman, M. A. (2023). The impact of tourism supply chain on sustainable performance in sub-Saharan Africa: Evidence from Tanzania. *Management of environmental quality: An international journal*, *34*(2), 492–510. https://doi.org/10.1108/MEQ-01-2022-0007

[16] Amani, D. (2023). The role of destination brand-oriented leadership in shaping tourism destination brand ambassadorship behavior among local residents in Tanzania. *Cogent social sciences*, *9*(2), 2266634. https://doi.org/10.1080/23311886.2023.2266634

[17] Amani, D. (2023). The interplay between tourism ethnocentrism, residents' support for tourism and destination brand value co-creation in emerging tourism destinations: Lessons from Tanzania. *Journal of quality assurance in hospitality & tourism*, 1–31. https://doi.org/10.1080/1528008X.2023.2293135

[18] Hesami, F. (2024). A hybrid ANP-TOPSIS method for strategic supplier selection in RL under rough uncertainty: A case study in the electronics industry. *Uncertainty discourse and applications*, *1*(1), 41–65. https://doi.org/10.48313/uda.v1i1.25

[19] Nazabadi, M. R., Najafi, S. E., & Rasinojehdehi, R. (2024). Integrated decision-making in production, maintenance, repair, and quality planning using an agent-based simulation. *Risk assessment and management decisions*, *1*(1), 12–21. https://doi.org/10.48314/ramd.v1i1.23

[20] Siraj, M. T., Haque, M. R., Chowdhury, M. S., Islam, N., Biswas, B., & Chowdhury, M. K. H. (2024). Analyzing challenges in enterprise resource planning (ERP) implementation in a safety inspection company: An IVT2IF DEMATEL approach. *Optimality*, *1*(2), 205–223. https://doi.org/10.22105/opt.v1i2.50

[21] Adak, A. K., Kamal, N., & Ali, W. (2024). Some characterization of fermatean fuzzy L-ring ideals. *Soft computing fusion with applications*, *1*(2), 76–86. https://doi.org/10.22105/scfa.v1i2.31

[22] Mehdiabadi, A., Sadeghi, A., Yazdi, A. K., & Tan, Y. (2025). Sustainability service chain capabilities in the oil and gas industry: A fuzzy hybrid approach SWARA-MABAC. *Spectrum of operational research*, *2*(1), 92–112. https://doi.org/10.31181/sor21202512

[23] Qian, S., Qiu, Y., Bouraima, M. B., Badi, I., & Chusi, T. N. (2024). Assessing the challenges to leverage carbon markets for renewable energy in developing countries: A multi-criteria decision-making approach. *Spectrum of engineering and management sciences*, *2*(1), 151–160. https://doi.org/10.31181/sems21202412s

[24] Chabok, S. H., & Tešić, D. (2024). Comprehensive strategic planning for construction companies using fuzzy MADM techniques. *Journal of operational and strategic analytics*, *2*(4), 235–253. http://dx.doi.org/10.56578/josa020403

[25] Nagarajan, D., Kanchana, A., Jacob, K., Kausar, N., Edalatpanah, S. A., & Shah, M. A. (2023). A novel approach based on neutrosophic bonferroni mean operator of trapezoidal and triangular neutrosophic interval environments in multi-attribute group decision making. *Scientific reports*, *13*(1), 10455. https://doi.org/10.1038/s41598-023-37497-z

[26] Jing, D., Imeni, M., Edalatpanah, S. A., Alburaikan, A., & Khalifa, H. A. E.-W. (2023). Optimal selection of stock portfolios using multi-criteria decision-making methods. *Mathematics*, *11*(2), 415. https://doi.org/10.3390/math11020415

[27] Nafei, A., Azizi, S. P., Edalatpanah, S. A., & Huang, C. Y. (2024). Smart TOPSIS: A neural network-driven TOPSIS with neutrosophic triplets for green supplier selection in sustainable manufacturing. *Expert systems with applications*, *255*, 124744. https://doi.org/10.1016/j.eswa.2024.124744

[28] Bakbak, D., Ulucay, V., & Edalatpanah, S. A. (2024). Trapezoidal fuzzy multi-number preference relations based on architecture multi-criteria decision-making application. *Iranian journal of fuzzy systems*, *21*(2), 51–65. https://doi.org/10.22111/ijfs.2023.44605.7853

[29] Palanikumar, M., Kausar, N., Ahmed, S. F., Edalatpanah, S. A., Ozbilge, E., & Bulut, A. (2023). New applications of various distance techniques to multi-criteria decision-making challenges for ranking vague sets. *AIMS mathematics*, *8*(5), 11397–11424. http://dx.doi.org/10.3934/math.2023577

[30] Akram, M., Bashir, A., & Edalatpanah, S. A. (2021). A hybrid decision-making analysis under complex q-rung picture fuzzy Einstein averaging operators. *Computational and applied mathematics*, *40*, 1–35. https://doi.org/10.1007/s40314-021-01651-y

[31] Sezgin, A., & Şenyiğit, E. (2025). A new product for soft sets with its decision-making: Soft star-product. *Big data and computing visions*, *5*(1), 52–73. https://doi.org/10.22105/bdcv.2024.492834.1221

[32] Senapati, T., & Yager, R. R. (2019). Fermatean fuzzy weighted averaging/geometric operators and its application in multi-criteria decision-making methods. *Engineering applications of artificial intelligence*, *85*, 112–121. https://doi.org/10.1016/j.engappai.2019.05.012

[33] Garg, H., Shahzadi, G., & Akram, M. (2020). Decision-making analysis based on Fermatean fuzzy Yager aggregation operators with application in COVID-19 testing facility. *Mathematical problems in engineering*, *2020*(1), 1–16. https://doi.org/10.1155/2020/7279027

[34] Ejegwa, P. A., & Zuakwagh, D. (2022). Fermatean fuzzy modified composite relation and its application in pattern recognition. *Journal of fuzzy extension and applications*, *3*(2), 140–151. https://doi.org/10.22105/jfea.2022.335251.1210

[35] Kiptum, C. K., Bouraima, M. B., Badi, I., Zonon, B. I. P., Ndiema, K. M., & Qiu, Y. (2023). Assessment of the challenges to urban sustainable development using an interval-valued fermatean fuzzy approach. *Systemic analytics*, *1*(1), 11–26. https://doi.org/10.31181/sa1120233

[36] Iqbal, W., Yang, T., & Ashraf, S. (2023). Optimizing earthquake response with fermatean probabilistic hesitant fuzzy sets: A decision support framework. *Journal of operational and strategic analytics*, *1*, 190–197. http://dx.doi.org/10.56578/josa010404

[37] Akram, M., Shah, S., Al-shamiri, M., & Edalatpanah, S. A. (2022). Extended DEA method for solving multi-objective transportation problem with Fermatean fuzzy sets. *AIMS mathematics*, *8*(1), 924–961. http://dx.doi.org/10.3934/math.2023045

[38] Akram, M., Shah, S. M. U., Al-Shamiri, M. M. A., & Edalatpanah, S. A. (2022). Fractional transportation problem under interval-valued Fermatean fuzzy sets. *AIMS math*, *7*(9), 17327–17348. http://dx.doi.org/10.3934/math.2022954

[39] Ali, R., Rahman, K., & Muhammad, J. (2024). Complex Fermatean fuzzy models and their algebraic aggregation operators in decision-making: A case study on COVID-19 vaccine selection. *Journal operation strateght analysis*, *2*(2), 119–135. https://doi.org/10.56578/josa020205

[40] Senapati, T., & Yager, R. R. (2020). Fermatean fuzzy sets. *Journal of ambient intelligence and humanized computing*, *11*(2), 663–674. https://doi.org/10.1007/s12652-019-01377-0

[41] Bouraima, M. B., Gore, A., Ayyildiz, E., Yalcin, S., Badi, I., Kiptum, C. K., & Qiu, Y. (2023). Assessing of causes of accidents based on a novel integrated interval-valued Fermatean fuzzy methodology: towards a sustainable construction site. *Neural computing and applications*, *35*(29), 21725–21750. https://doi.org/10.1007/s00521-023-08948-5

[42] Simić, V., Ivanović, I., Đorić, V., & Torkayesh, A. E. (2022). Adapting urban transport planning to the COVID-19 pandemic: An integrated Fermatean fuzzy model. *Sustainable cities and society*, *79*, 103669. https://doi.org/10.1016/j.scs.2022.103669

[43] Bouraima, M. B., Ibrahim, B., Qiu, Y., Muhammad, L. J., & Radovanović, M. (2024). Assessment of solar energy technologies in meeting the 2030 agenda and sustainable development goals under an interval-valued fermatean fuzzy environment. *Journal of operations intelligence*, *2*(1), 114–128. https://doi.org/10.31181/jopi21202412

[44] Akram, M., Shahzadi, G., & Ahmadini, A. A. H. (2020). Decision-making framework for an effective sanitizer to reduce COVID-19 under Fermatean fuzzy environment. *Journal of mathematics*, *2020*(1), 1–19. https://doi.org/10.1155/2020/3263407

[45] Kizielewicz, B., & Sałabun, W. (2024). SITW method: A new approach to re-identifying multi-criteria weights in complex decision analysis. *Spectrum of mechanical engineering and operational research*, *1*(1), 215–226. https://doi.org/10.31181/smeor11202419

[46] Moslem, S. (2024). A novel parsimonious spherical fuzzy analytic hierarchy process for sustainable urban transport solutions. *Engineering applications of artificial intelligence*, *128*, 107447. https://doi.org/10.1016/j.engappai.2023.107447

[47] Žižović, M., & Pamucar, D. (2019). New model for determining criteria weights: Level based weight assessment (LBWA) model. *Decision making: Applications in management and engineering*, *2*(2), 126–137. https://doi.org/10.31181/dmame1902102z

[48] Ecer, F., Pamucar, D., Mardani, A., & Alrasheedi, M. (2021). Assessment of renewable energy resources using new interval rough number extension of the level based weight assessment and combinative distance-based assessment. *Renewable energy*, *170*, 1156–1177. https://doi.org/10.1016/j.renene.2021.02.004

[49] Biswas, S., Pamučar, D., Božanić, D., & Halder, B. (2022). A New spherical fuzzy LBWA-MULTIMOOSRAL framework: Application in evaluation of leanness of MSMEs in India. *Mathematical problems in engineering*, *2022*, 1–17. https://doi.org/10.1155/2022/5480848

[50] Rezaei, J. (2015). Best-worst multi-criteria decision-making method. *Omega*, *53*, 49–57. https://doi.org/10.1016/j.omega.2014.11.009

[51] Rezaei, J. (2016). Best-worst multi-criteria decision-making method: Some properties and a linear model. *Omega*, *64*, 126–130. https://doi.org/10.1016/j.omega.2015.12.001

[52] Ghoushchi, S. J., Bonab, S. R., Ghiaci, A. M., Haseli, G., Tomaskova, H., & Hajiaghaei-Keshteli, M. (2021). Landfill site selection for medical waste using an integrated SWARA-WASPAS framework based on spherical fuzzy set. *Sustainability*, *13*(24), 13950. https://doi.org/10.3390/su132413950

[53] Ghasemian Sahebi, I., Arab, A., & Toufighi, S. P. (2020). Analyzing the barriers of organizational transformation by using fuzzy SWARA. *Journal of fuzzy extension and applications*, *1*(2), 84–97. https://doi.org/10.22105/jfea.2020.249191.1010

[54] Mohamed, M., Salam, A., Ye, J., & Yong, R. (2024). A hybrid triangular fuzzy SWARA-MAROCS approach for selecting optimal and smart logistic enterprise based on IoT, Blockchain, and UAVs. *Multicriteria algorithms with applications*, *4*, 1–15. https://doi.org/10.61356/j.mawa.2024.4241

[55] Chusi, T. N., Qian, S., Edalatpanah, S. A., Qiu, Y., Bayane Bouraima, M., & Ajayi, A. B. (2024). Interval-valued spherical fuzzy extension of SWARA for prioritizing strategies to unlock Africa's potential in the carbon credit market. *Computational algorithms and numerical dimensions*, *3*(3), 217–227. https://doi.org/10.22105/cand.2024.474739.1106

[56] Ajalli, M., Saberifard, N., & Zinati, B. (2022). Evaluation and ranking of performance indicators in humanitarian logistics using path analysis, fuzzy DEMATEL and SWARA. *Journal of decisions and operations research*, *6*(Spec. Issue), 1-20. (**In Persian**). https://doi.org/10.22105/dmor.2021.270180.1307

[57] Wassenaar, H. J., & Chen, W. (2003). An approach to decision-based design with discrete choice analysis for demand modeling. *Journal mechanical design*, *125*(3), 490–497. https://doi.org/10.1115/1.1587156

[58] Torkayesh, A. E., & Deveci, M. (2021). A multi-normalization multi-distance assessment (TRUST) approach for locating a battery swapping station for electric scooters. *Sustainable cities and society*, *74*, 103243. https://doi.org/10.1016/j.scs.2021.103243

[59] Vafaei, N., Ribeiro, R., & Camarinha-Matos, L. (2015). *Importance of data normalization in decision making: Case study with topsis method* [presentation]. International conference on decision support systems technologies an ewg-dss conference (pp. 27-29). https://www.researchgate.net/publication/304539326

[60] Bošković, S., Švadlenka, L., Jovčić, S., Dobrodolac, M., Simić, V., & Bacanin, N. (2023). An alternative ranking order method accounting for two-step normalization (AROMAN)—A case study of the electric vehicle selection problem. *IEEE access*, *11*, 39496–39507. https://doi.org/10.1109/ACCESS.2023.3265818

[61] Bouraima, M. B., Jovčić, S., Dobrodolac, M., Dragan, P., Ibrahim, B., & Maraka, N. D. (2024). Sustainable healthcare system devolution strategy selection using the AROMAN MCDM approach. *Spectrum of decision making and applications*, *1*(1), 46–63. https://doi.org/10.31181/sdmap1120243

[62] Buhalis, D., Leung, D., & Lin, M. (2023). Metaverse as a disruptive technology revolutionising tourism management and marketing. *Tourism management*, *97*, 104724. https://doi.org/10.1016/j.tourman.2023.104724

[63] Aguinis, H., Kraus, S., Poček, J., Meyer, N., & Jensen, S. H. (2023). The why, how, and what of public policy implications of tourism and hospitality research. *Tourism management*, *97*, 104720. https://doi.org/10.1016/j.tourman.2023.104720

[64] Gursoy, D., Li, Y., & Song, H. (2023). ChatGPT and the hospitality and tourism industry: An overview of current trends and future research directions. *Journal of hospitality marketing & management*, *32*(5), 579–592. https://doi.org/10.1080/19368623.2023.2211993

[65] Peeters, P., Çakmak, E., & Guiver, J. (2024). Current issues in tourism: Mitigating climate change in sustainable tourism research. *Tourism management*, *100*, 104820. https://doi.org/10.1016/j.tourman.2023.104820

[66] Miller, G., & Torres-Delgado, A. (2023). Measuring sustainable tourism: A state of the art review of sustainable tourism indicators. *Journal of sustainable tourism*, *31*(7), 1483–1496. https://doi.org/10.1080/09669582.2023.2213859

[67] Bianchi, R. V, & Milano, C. (2024). Polycrisis and the metamorphosis of tourism capitalism. *Annals of tourism research*, *104*, 103731. https://doi.org/10.1016/j.annals.2024.103731

[68] Dube, K., Nhamo, G., Kilungu, H., Hambira, W. L., El-Masry, E. A., Chikodzi, D., … ., & Molua, E. L. (2024). Tourism and climate change in Africa: Informing sector responses. *Journal of sustainable tourism*, *32*(9), 1811–1831. https://doi.org/10.1080/09669582.2023.2193355

[69] Xuanming, P., Dossou, T. A. M., Dossou, K. P., & Alinsato, A. S. (2024). The impact of tourism development on social welfare in Africa: Quantile regression analysis. *Current issues in tourism*, *27*(7), 1159–1172. https://doi.org/10.1080/13683500.2023.2214351

[70] Mutanga, C. N., Kolawole, O. D., Gondo, R., & Mbaiwa, J. E. (2024). A review and SWOC analysis of natural heritage tourism in sub-Saharan Africa. *Journal of heritage tourism*, *19*(1), 49–67. https://doi.org/10.1080/1743873X.2023.2255689

[71] Adeniyi, O., Adekunle, W., Afolabi, J., & Kumeka, T. T. (2024). Tourism-income inequality Nexus in Africa: Evidence from SADC countries. *Current issues in tourism*, *27*(18), 2899–2917. https://doi.org/10.1080/13683500.2023.2227377

[72] Ghaforiyan, M., Sorourkhah, A., & Edalatpanah, S. A. (2024). Identifying and prioritizing antifragile tourism strategies in a Neutrosophic environment. *Journal of fuzzy extension and applications*, *5*(3), 374–394. https://doi.org/10.22105/jfea.2024.456894.1470

[73] Pourmorshed, S. S., Sajadi, S. M., & Sadeghian Esfahani, S. (2022). Eco-tourism residences in Iran: A multiple case study research with a creative tourism approach. *Journal of applied research on industrial engineering*, *9*(4), 427–441. https://doi.org/10.22105/jarie.2022.326273.1444

[74] Kordsofla, M. M., & Sorourkhah, A. (2023). Strategic adaptation in travel agencies: Integrating MARA with SWOT for uncertainty navigation. *Journal of operational and strategic analytics*, *1*(4), 173–188. https://doi.org/10.56578/josa010403

[75] Heidari Haratemeh, M., & Ebrahimi, B. (2024). Investigating the effects of exchange rate volatility on tourist flows. *Financial and banking strategic studies*, *2*(1), 36-44. (**In Persian**). https://doi.org/10.22105/fbs.2024.193850

[76] Niki, N., & Shirouyehzad, H. (2023). Ranking of European countries in the tourism industry in 2019 using data envelopment analysis. *Modern research in performance evaluation*, *2*(1), 24-31. (**In Persian**). https://doi.org/10.22105/mrpe.2023.176747

[77] Tian, S., Liu, C., & Jiang, F. (2023). Evaluation of customer value-based pricing strategies in hainan's travel agencies under a free trade port framework. *Journal of operational and strategic analytics*, *1*, 198–213. http://dx.doi.org/10.56578/josa010405

[78] Abdinematabad, S., Ebadikhah, R., Pourabdollah, M., & Rasinojehdehi, R. (2023). Unveiling patterns: A data-driven exploration of overseas residents' views on Qingdao's tourism development. *Computational algorithms and numerical dimensions*, *2*(3), 173–185. https://doi.org/10.22105/cand.2023.432811.1082

[79] Asadi-Lari, M. S., Abbas Ghorbani, M., & Tavakkoli-Moghaddam, R. (2023). Multi-objective mathematical modeling focused on hotel revenue and passenger cost by NSGA-II and MOPSO. *Journal of decisions and operations research*, *8*(1), 39-71. (**In Persian**). https://doi.org/10.22105/dmor.2023.361666.1691

[80] Ghasemi, M., & Mohtadi, M. M. (2023). Identifying, evaluating and ranking effective factors in improving the quality of war tourism in Iran (Rahyan Noor travels). *Innovation management and operational strategies*, *3*(4), 465-482. (**In Persian**). https://doi.org/10.22105/imos.2022.339219.1228

[81] Imran, M., & Ali, N. (2024). Exploring the synergy between tourism and economic development in Pakistan. *Systemic analytics*, *2*(1), 48–58. https://doi.org/10.31181/sa21202413

[82] Uluçay, V., & Okumuş, N. (2024). A new generalized similarity measure based on intuitionistic trapezoidal fuzzy multi-numbers: Turkey's sustainable tourism economy strategy application. *Journal of fuzzy extension and applications*, *5*(2), 238–250. https://doi.org/10.22105/jfea.2024.447222.1403

[83] Chu, C. H., & Liu, S. C. (2024). The impact of corporate core values on service quality management strategies: A study of grand earl hotel in Taiwan. *Management analytics and social insights*, *1*(1), 40–49. https://doi.org/10.22105/masi.v1i1.21

[84] Genç, E., Keleş, M. K., & Özdağoğlu, A. (2024). A hybrid MCDM model for personnel selection based on a novel gray AHP, gray MOORA and gray MAUT methods in terms of business management: An application in the tourism sector. *Journal of decision analytics and intelligent computing*, *4*(1), 263–284. https://doi.org/10.31181/jdaic10024122024g

[85] Liu, X., Li, M. Y., Ma, Y. M., Gao, T. H., & Yuan, D. N. (2024). Personalized tourism product design focused on tourist expectations and online reviews: An integrated MCDM method. *Computers & industrial engineering*, *188*, 109860. https://doi.org/10.1016/j.cie.2023.109860

[86] Xu, M., Bai, C., Shi, L., Puška, A., Štilić, A., & Stević, Ž. (2023). Assessment of mountain tourism sustainability using integrated fuzzy MCDM model. *Sustainability*, *15*(19), 14358. https://doi.org/10.3390/su151914358

[87] Jena, R. K., & Dwivedi, Y. (2023). Prioritizing the barriers to tourism growth in rural India: an integrated multi-criteria decision making (MCDM) approach. *Journal of tourism futures*, *9*(3), 393–416. https://doi.org/10.1108/JTF-10-2020-0171

[88] Maracajá, K. F. B., Batista Schramm, V., Schramm, F., Valduga, V., & Trindade, J. R. (2023). Application of MCDM using PROMETHEE II for evaluation of wine tourism services. *International journal of wine business research*, *35*(3), 427–444. https://doi.org/10.1108/IJWBR-07-2022-0025

[89] Ayvaz-Çavdaroğlu, N., Iyanna, S., & Foster, M. (2024). Smart service quality in hospitality – a quantitative assessment using MCDM and clustering methods. *International journal of hospitality management*, *123*, 103931. https://doi.org/10.1016/j.ijhm.2024.103931

[90] Kang, D., Manirathinam, T., Sandra, M., Pragathi, S., Narayanamoorthy, S., Bajuri, M. Y., … ., & Ahmadian, A. (2024). Measuring priorities of sustainable post-pandemic tourism policy factors using novel fuzzy multi-criteria decision making approach. *Journal of sustainable tourism*, *32*(11), 2286–2303. https://doi.org/10.1080/09669582.2023.2283374

[91] Lin, P. P., Li, D. F., Jiang, B. Q., Yu, G. F., & Wei, A. P. (2020). Evaluating the comprehensive impacts of tourism in Hainan by intergrating input-output model with MCDM methods. *Technological and economic development of economy*, *26*(5), 989–1029. https://doi.org/10.3846/tede.2020.12706

[92] Liu, C. H., Tzeng, G. H., Lee, M. H., & Lee, P. Y. (2013). Improving metro–airport connection service for tourism development: Using hybrid MCDM models. *Tourism management perspectives*, *6*, 95–107. https://doi.org/10.1016/j.tmp.2012.09.004

[93] Alptekin, G. I., & Büyüközkan, G. (2011). An integrated case-based reasoning and MCDM system for Web based tourism destination planning. *Expert systems with applications*, *38*(3), 2125–2132. https://doi.org/10.1016/j.eswa.2010.07.153

[94] Ayyildiz, E. (2022). Fermatean fuzzy step-wise weight assessment ratio analysis (SWARA) and its application to prioritizing indicators to achieve sustainable development goal-7. *Renewable energy*, *193*, 136–148. https://doi.org/10.1016/j.renene.2022.05.021

[95] Aytekin, A., Görçün, Ö. F., Ecer, F., Pamucar, D., & Karamaşa, Ç. (2023). Evaluation of the pharmaceutical distribution and warehousing companies through an integrated Fermatean fuzzy entropy-WASPAS approach. *Kybernetes*, *52*(11), 5561–5592. https://doi.org/10.1108/K-04-2022-0508

[96] Keršuliene, V., Zavadskas, E. K., & Turskis, Z. (2010). Selection of rational dispute resolution method by applying new step-wise weight assessment ratio analysis (Swara). *Journal of business economics and management*, *11*(2), 243–258. https://doi.org/10.3846/jbem.2010.12

[97] Hashemkhani Zolfani, S., Yazdani, M., & Zavadskas, E. K. (2018). An extended stepwise weight assessment ratio analysis (SWARA) method for improving criteria prioritization process. *Soft computing*, *22*(22), 7399–7405. https://doi.org/10.1007/s00500-018-3092-2

[98] Kara, K., Yalçın, G. C., Acar, A. Z., Simic, V., Konya, S., & Pamucar, D. (2024). The MEREC-AROMAN method for determining sustainable competitiveness levels: A case study for Turkey. *Socio-economic planning sciences*, *91*, 101762. https://doi.org/10.1016/j.seps.2023.101762

[99] Simic, V., Karagoz, S., Deveci, M., & Aydin, N. (2021). Picture fuzzy extension of the CODAS method for multi-criteria vehicle shredding facility location. *Expert systems with applications*, *175*, 114644. https://doi.org/10.1016/j.eswa.2021.114644

[100] Maharaj, B., Sucheran, R., & Pillay, V. (2006). Durban-a tourism mecca? challenges of the post-apartheid era. *Urban forum, 17(3),* 262-281. https://doi.org/10.1007/s12132-006-0012-9

[101] Elliott, J. (2020). *Tourism: Politics and public sector management*. Routledge. https://doi.org/10.4324/9781003070986

[102] Kaosa-ard, M., Bezic, D., & White, S. (2013). Domestic tourism in Thailand: Supply and demand. In *The native tourist* (pp. 109–141). Routledge. https://doi.org/10.4324/9781315870564

[103] Aramberri, J. (2004). Reading the tourist mind: Indian tourism the next decade. *Tourism recreation research*, *29*(1), 1–13. https://doi.org/10.1080/02508281.2004.11081426

[104] Jerenashvili, N. (2014). Domestic tourism in Georgia: Quantitative analysis. *European scientific journal*, *2*, 44–51. https://core.ac.uk/reader/236404780

[105] Görçün, Ö. F., Aytekin, A., & Korucuk, S. (2023). Fresh food supplier selection for global retail chains via bipolar neutrosophic methodology. *Journal of cleaner production*, *419*, 138156. https://doi.org/10.1016/j.jclepro.2023.138156

[106] Aytekin, A. (2022). Energy, environment, and sustainability: A multi-criteria evaluation of countries. *Strategic planning for energy and the environment*, *41*(3), 281–316. https://doi.org/10.13052/spee1048-5236.4133

[107] Bouraima, M. B., Badi, I., Makinde, O. O., Kassembe, E. A., & Muya, F. (2025). Prioritizing strategies for the development and sustainability of higher education in developing countries: A FullEX MCDM approach. *Spectrum of decision making and applications*, *2*(1), 166–176. https://doi.org/10.31181/sdmap21202516

[108] Sangaré-Oumar, M. M., Qian, S., Qiu, Y., Bouraima, M. B., Badi, I., & Tengecha, N. A. (2025). Evaluation of factors influencing university graduates' unemployment in developing country: A multi-criteria decision-making perspective. *Spectrum of operational research*, *2*(1), 151–160. https://doi.org/10.31181/sor21202516

[109] Mato, M., & Mosoma, D. (2022). Factors influencing domestic tourism in Tanzania: A case of Arusha City. *International journal of engineering, business and management*, *6*(4), 1–11. https://dx.doi.org/10.22161/ijebm.6.4.1

[110] Charles, G. (2019). Coordinating regulatory agencies for improved tourism policy in Tanzania. *Journal of hospitality and tourism insights*, *2*(1), 2–17. https://doi.org/10.1108/JHTI-08-2018-0049

Appendix

The preliminaries of FFSs are shown belows.

A FFS B in the discourse universe X can be stated as $B = \{\langle x, \mu_B(x), v_B(x)\rangle : x \in X\}$. Here, $\mu_B(x)$ is the membership degree, and $v_B(x)$ is the non-membership degree of the element x, where $\mu_B(x): X \to [0,1], v_B(x): X \to [0,1]$ and $0 \le (\mu_B(x))^3 + (v_B(x))^3 \le 1$ .For convenience, a FF number can be stated as $b_1 = (\mu_1, v_1)$.

Let $b_j = (\mu_j, v_j)$ be the collection of FFNs. Then basic operations and FF Weighted Averaging Operator (FFWAO) is presented below, where $j = 1, \dots, n, \lambda > 0, 0 \le w_j \le 1, \sum_{j=1}^{n} w_j = 1$ [94], [95].

$$b_1 \oplus b_2 = \left(\sqrt[3]{\mu_1^3 + \mu_2^3 - \mu_1^3\mu_2^3}, v_1 v_2\right). \tag{1}$$

$$b_1 \otimes b_2 = \left(\mu_1^3\mu_2^3, \sqrt[3]{v_1^3 + v_2^3 - v_1^3 v_2^3}\right). \tag{2}$$

$$\lambda. b_1 = \left(\sqrt[3]{1 - (1 - \mu_1^3)^\lambda}, v_1^\lambda\right). \tag{3}$$

$$b_1^\lambda = \left(\mu_1^\lambda, \sqrt[3]{1 - (1 - v_1^3)^\lambda}\right). \tag{4}$$

$$S(b_1) = 1 + \mu_1^3 - v_1^3. \tag{5}$$

$$FFWAO_{w_j}(b_1, b_2, \dots, b_n) = \left(\prod_{j=1}^{n} (\mu_j)^{w_j}, \sqrt[3]{1 - \prod_{j=1}^{n} \left(1 - (v_j)^3\right)^{w_j}}\right). \tag{6}$$

Phase 1 (FF-SWARA). The steps of the FF-SWARA approach are as follows [94]:

Step 1. A decision matrix is established by using the expert's point of view related to criteria using *Table A1* in Appendix [99]. The assessment of criterion i by expert t is $A_{it} = (\mu_{it}, v_{it})$. The conversion to FFN is done using the scale from *Table A1* in appendix.

Step 2. The FF decision matrix is established through the aggregation of the expert's point of view. The expert's weight (ψ_t) is considered when performing the aggregation.

$$z_i = Y(\mu_i, v_i) = \left(\prod_{t=1}^{d} (\mu_{it})^{\psi_t}, \sqrt[3]{1 - \prod_{t=1}^{d} (1 - (v_{it})^3)^{\psi_t}}\right), \quad i = 1, \dots, n, \tag{7}$$

where z_i-aggregated assessment for criterion i, n-criteria number.

Step 3. Computation of criterion positive score S^+ (i) through *Eq. (8)*.

$$S^+(i) = 1 + \mu_i^3 - v_i^3. \tag{8}$$

Step 4. Rank criteria based on the scores of their positive values.

Step 5. Determination of comparative importance (c_i) for each criterion.

Step 6. Calculation of comparative coefficient (k_i) for each criterion.

$$k_i = \begin{cases} 1, & i = 1, \\ S^+(i) + 1, & i > 1. \end{cases} \quad (9)$$

Step 7. Estimation of recomputed weights (q_i).

$$q_i = \begin{cases} 1, & i = 1, \\ \frac{q_{(i-1)}}{k_i}, & i > 1. \end{cases} \quad (10)$$

Step 8. Final criteria weights are determined by using *Eq. (11)*:

$$w_i = \frac{q_i}{\sum_{i=1}^{n} q_i}, \quad (11)$$

where n denotes the number of criteria.

Phase 2. The AROMAN method

Step 9. In this phase, a decision-making matrix Y_{mxn} with the input data $y_{11},\ldots, y_{2j}, \ldots, y_{mn}$, is formulated (*Eq. (12)*):

$$Y = \begin{bmatrix} y_{11} & \cdots & y_{1j} & \cdots & y_{1n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ y_{21} & \cdots & y_{2j} & \cdots & y_{2n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ y_{m1} & \cdots & y_{mj} & \cdots & y_{mn} \end{bmatrix}, \ i = 1,2, \ldots, m, j = 1,2, \ldots, n. \quad (12)$$

Step 10. Upon establishing the decision-making problem matrix, the subsequent phase involves normalizing the data. The AROMAN method integrates two normalization techniques, namely linear (*Eq. (13)*) and vector (*Eq. (14)*), to produce an aggregated normalized matrix (*Eq. (15)*).

$$P_{ij} = \frac{y_{ij} - \min_i y_{ij}}{\max_i y_{ij} - \min_i y_{ij}}, i = 1, 2, \ldots, m; \ j = 1,2, \ldots, n. \quad (13)$$

$$P_{ij}^* = \frac{y_{ij}}{\sqrt{\sum_{i=1}^{m} y_{ij}^2}}, i = 1, 2, \ldots, m, j = 1, 2, \ldots, n. \quad (14)$$

$$P_{ij}^{norm} = \frac{\mu P_{ij} + (1-\mu) P_{ij}^*}{2}, i = 1,2, \ldots, m; \ j = 1, 2, \ldots, n, \quad (15)$$

where P_{ij}^{norm}- aggregated averaged normalization; μ-weighting factor changing from 0 to 1. In our case, μ =0.5.

Step 11. *Eq. (16)* calculates this phase.

$$\widehat{P_{ij}} = W_{ij} \cdot P_{ij}^{norm}, i = 1,2, \ldots, m; \ j = 1, 2, \ldots, n. \quad (16)$$

Step 12. Obtention of a sum of the normalized weighted values calculated (*Eq. (17)* and *Eq. (18)*), respectively:

$$D_i = \sum_{j=1}^{n} \widehat{P_{ij}}^{(min)}, i = 1,2, \ldots, m; \ j = 1, 2, \ldots, n. \quad (17)$$

$$U_i = \sum_{j=1}^{n} \widehat{P_{ij}}^{(max)}, i = 1,2, \ldots, m; \ j = 1, 2, \ldots, n. \quad (18)$$

Step 13. The sum of D_i and U_i values are raised to the δ and 1- δ levels, respectively.

$$D_i^{\wedge} = D_i^{\delta} = \left(\sum_{j=1}^{n} \widehat{P_{ij}}^{(min)}\right)^{\delta}, \quad (19)$$

$$U_i^{\wedge} = U_i^{1-\delta} = \left(\sum_{j=1}^{n} \widehat{P_{ij}}^{(max)}\right)^{1-\delta}, \quad (20)$$

where δ- coefficient level framed in [0,1]

Step 15. The difference between the values $U_i^{\wedge}$ and $D_i^{\wedge}$ are computed and the final ranking equation S_i is applied as follows:

$$S_i = e^{(U_i^{\wedge} - D_i^{\wedge})}. \quad (21)$$

Table A1. Evaluation of criteria using linguistic terms.

Linguistic Term	μ	v
Extremely important-E	0.975	0.10
Very important-V	0.85	0.20
Important-I	0.70	0.35
Moderately important-M	0.55	0.50
Slightly important-S	0.35	0.70
Not important-N	0.20	0.85
Extremely unimportant-U	0.10	0.975

Table A2. Criteria and alternative definition.

Criteria and Alternative	Description	References
Lack of attention from the government towards domestic tourism (C1)	This is due to low investment, misconceptions about local tourists' economic value, limited awareness of attractions, and economic barriers that make travel unaffordable for many.	Bakari [10]
Poor service quality to domestic tourists (C2)	This is due to inadequate training of providers, a focus on international visitors, and financial constraints. Poor infrastructure and cultural attitudes further exacerbate the issue, along with staffing inconsistencies and a lack of feedback mechanisms for improvement.	Expert opinion
Lack of domestic tourism promotion marketing packages (C3)	This is due to a lack of tailored marketing packages and primary focus on international tourists. Many operators overlook local travelers as a viable market.	Bakari [10]
Poor attitude of the government bodies towards domestic tourism (C4)	This is due to a historical focus on international tourism as the primary revenue source. This leads to neglect of local initiatives, as domestic travelers are perceived as less profitable.	Expert opinion
Absence of domestic tourism development and marketing policy and strategy (C5)	This is due to fragmented governance, inadequate funding, and a lack of research on domestic tourism needs.	Expert opinion
Strategy of popularizing tourist attraction and events (S1)	Domestic tourists need diverse attractions and events. A database of tourist sites and an events calendar should be created, and festivals like Sauti za Busara in Zanzibar should be better promoted to attract more visitors.	Buhalis et al. [62]

Table A2. Continued.

Criteria and Alternative	Description	References
Focusing on new market strategy (S2)	This strategy will shape domestic tourism marketing in the years ahead, aiming to create a unique national park identity and utilize advanced promotional techniques.	Aguinis et al. [63]
Developing domestic tourism infrastructure strategy (S3)	Improving infrastructure in major cities and tourist destinations is crucial for fostering a supportive environment for domestic tourism.	Gursoy et al. [64]
Diversifying domestic tourism strategy (S4)	Eco-domestic tourism should be prioritized by offering adventure tours that highlight the country's natural landscapes and ecological features.	Peeters et al. [65]
Promoting up-scale domestic tourism strategy (S5)	Domestic tourism should be expanded by offering beyond safari markets to attract a broader range of tourists. It should promote cultural experiences, scenic attractions, and eco-tourism, enabling the industry to capitalize on the profitable domestic tourism market.	Miller and Torres-Delgado [66]

Table A3. Expert alternative assessment.

S1	C1	C2	C3	C4	C5	S2	C1	C2	C3	C4	C5
E1	3	5	5	5	8	E1	3	5	3	7	8
E2	7	5	6	3	6	E2	5	6	7	7	6
E3	5	4	7	3	5	E3	5	6	5	3	8
E4	7	3	3	7	7	E4	7	5	5	3	6
A	5.5	4.25	5.25	4.5	6.5	A	5	5.5	5	5	7
S3	**C1**	**C2**	**C3**	**C4**	**C5**	**S4**	**C1**	**C2**	**C3**	**C4**	**C5**
E1	8	4	4	8	7	E1	8	8	8	8	7
E2	5	5	6	6	6	E2	7	7	3	5	5
E3	3	3	5	8	3	E3	3	3	5	7	8
E4	7	3	3	4	6	E4	3	3	5	7	8
A	5.75	3.75	4.5	6.5	5.5	A	5.25	5.25	5.25	6.75	7
S5	**C1**	**C2**	**C3**	**C4**	**C5**						
E1	5	6	8	8	8						
E2	7	7	7	6	6						
E3	5	6	5	3	7						
E4	5	6	5	3	7						
A	5.5	5.75	6.25	5.75	7.25						

Table A4. Scenarious for weight fluctuations.

Scenarios	Weight Coefficients of Criteria				
	C1	C2	C3	C4	C5
T0	0.1761	0.1477	0.2262	0.2043	0.2457
T1	0.1477	0.2262	0.2043	0.2457	0.1761
T2	0.2262	0.2043	0.2457	0.1761	0.1477
T3	0.2043	0.2457	0.1761	0.1477	0.2262
T4	0.2457	0.1761	0.1477	0.2262	0.2043
T5	0.1585	0.1521	0.2306	0.2087	0.2501
T6	0.1409	0.1565	0.2350	0.2131	0.2545
T7	0.1233	0.1609	0.2394	0.2175	0.2589
T8	0.1057	0.1653	0.2438	0.2219	0.2633
T9	0.0881	0.1697	0.2482	0.2263	0.2677

Table A4. Continued.

Scenarios	Weight Coefficients of Criteria				
	C1	**C2**	**C3**	**C4**	**C5**
T10	0.0705	0.1741	0.2526	0.2307	0.2721
T11	0.0528	0.1785	0.2570	0.2351	0.2765
T12	0.0352	0.1829	0.2614	0.2395	0.2809
T13	0.0176	0.1873	0.2658	0.2439	0.2853
T14	0.0000	0.1917	0.2702	0.2483	0.2898
T15	0.1798	0.1329	0.2299	0.2080	0.2494
T16	0.1835	0.1181	0.2336	0.2117	0.2531
T17	0.1872	0.1034	0.2373	0.2154	0.2568
T18	0.1909	0.0886	0.2410	0.2191	0.2605
T19	0.1946	0.0738	0.2446	0.2228	0.2642
T20	0.1983	0.0591	0.2483	0.2265	0.2679
T21	0.2020	0.0443	0.2520	0.2302	0.2716
T22	0.2057	0.0295	0.2557	0.2338	0.2753
T23	0.2093	0.0148	0.2594	0.2375	0.2789
T24	0.2130	0.0000	0.2631	0.2412	0.2826
T25	0.1818	0.1533	0.2036	0.2100	0.2514
T26	0.1874	0.1590	0.1809	0.2156	0.2570
T27	0.1931	0.1646	0.1583	0.2213	0.2627
T28	0.1987	0.1703	0.1357	0.2269	0.2683
T29	0.2044	0.1759	0.1131	0.2326	0.274
T30	0.2101	0.1816	0.0905	0.2382	0.2796
T31	0.2157	0.1872	0.0679	0.2439	0.2853
T32	0.2214	0.1929	0.0452	0.2496	0.2910
T33	0.2270	0.1985	0.0226	0.2552	0.2966
T34	0.2327	0.2042	0.0000	0.2609	0.3023
T35	0.1812	0.1528	0.2313	0.1839	0.2508
T36	0.1863	0.1579	0.2364	0.1635	0.2559
T37	0.1914	0.1630	0.2415	0.1430	0.2610
T38	0.1966	0.1681	0.2466	0.1226	0.2662
T39	0.2017	0.1732	0.2517	0.1022	0.2713
T40	0.2068	0.1783	0.2568	0.0817	0.2764
T41	0.2119	0.1834	0.2619	0.0613	0.2815
T42	0.2170	0.1885	0.2670	0.0409	0.2866
T43	0.2221	0.1936	0.2722	0.0204	0.2917
T44	0.2272	0.1987	0.2773	0.0000	0.2968
T45	0.1823	0.1538	0.2323	0.2105	0.2211
T46	0.1884	0.1599	0.2385	0.2166	0.1966
T47	0.1946	0.1661	0.2446	0.2227	0.1720
T48	0.2007	0.1722	0.2508	0.2289	0.1474
T49	0.2068	0.178	0.2569	0.2350	0.1229
T50	0.2130	0.1845	0.2630	0.2412	0.0983
T51	0.2191	0.1907	0.2692	0.2473	0.0737
T52	0.2253	0.1968	0.2753	0.2535	0.0491
T53	0.2314	0.2029	0.2815	0.2596	0.0246
T54	0.2376	0.2091	0.2876	0.2657	0.0000