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Selection of Amenities Suppliers for SEN Grand Hotel and Spa, Hanoi, Vietnam Using the TOPSIS Method

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ABSTRACT

Introduction: Effective supply chain management plays a crucial role in the hospitality industry, particularly in supplier selection, as it directly impacts service quality, operational costs, and customer experience. The TOPSIS method, when combined with AHP, helps optimize the supplier evaluation process by reducing subjectivity and prioritizing key performance indicators. Important criteria include price, quality, delivery time, and reliability, with product quality, delivery performance, and supplier reputation being the key factors. The trend of integrating sustainability criteria into supplier evaluation is gaining increasing attention, considering economic, social, and environmental factors.

Objectives: This study aims to evaluate and select the most suitable supplier of convenience items for SEN Grand Hotel & Spa, Hanoi, Vietnam, using the TOPSIS method. The specific objectives include: (i) Identifying key criteria in supplier selection, including service quality, delivery time, cost, reliability, and environmental friendliness; (ii) Applying the TOPSIS method to rank and select the most appropriate supplier; (iii) Proposing an objective decision-making approach to optimize the supply chain and enhance hotel service quality.

Methods: This study employs a quantitative approach using the multi-criteria decision-making technique TOPSIS to evaluate and select suppliers. Data is collected from relevant sources, including information on potential suppliers and evaluations based on five key criteria. After processing the data, TOPSIS is applied to rank suppliers according to their suitability for the hotel's needs. The final results determine the highest-scoring supplier, ensuring objectivity and optimization in the decision-making process.

Results: Based on the ranking of suppliers, SEN Grand Hotel and Spa can prioritize the selection of amenities suppliers in the following order: Tân Định, TNS Ecomenities, Horecas, Nanomex, and Haloyal.

Conclusions: This study has demonstrated the applicability of the TOPSIS method in selecting amenities suppliers for hotels, helping to minimize subjectivity and ensure data-driven decision-making. The findings not only assist SEN Grand Hotel & Spa in optimizing its procurement process but also contribute to the sustainable supply chain management trend in the hospitality industry.

Keywords: Amenities Suppliers, SEN Grand Hotel, TOPSIS Method, Vietnam.

INTRODUCTION

Effective supply chain management plays a crucial role in the hospitality industry, not only enhancing operational efficiency but also ensuring optimal service quality, particularly in supplier selection. The decision to choose a supplier directly impacts service quality and customer satisfaction. (S Senathirajah et al., 2024) as well as operating costs, thereby significantly impacting the overall customer experience (Asal Safavi, Bahram Sadeghi Bigham, 2024).

Moreover, service quality is a key factor in enhancing competitive advantage and operational efficiency in the hospitality industry (Nguyen & Ngoc, 2024). Implementing a standardized supplier selection process helps optimize operations, reduce operating costs, and foster strategic partnerships. At the same time, it also improves information sharing—an essential aspect of customer-oriented activities (Kachwala, 2024). Recent studies have also highlighted the growing importance of sustainability in supplier evaluation processes, as economic, social, and environmental factors are increasingly prioritized (Masudin et al., 2024).

In this context, the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method serves as an effective decision-making tool, particularly suitable for the hospitality industry, where balancing quality and cost is crucial. This method minimizes subjectivity in the evaluation process by using objective criterion weights, thereby improving the accuracy of supplier rankings. (Yudhistira et al., 2024); (Teg Alam, 2024); (Rudnik et al., 2024). When integrated with Analytic Hierarchy Process (AHP), TOPSIS becomes even more effective by prioritizing key performance indicators (KPIs) and providing a structured evaluation process. (Phan Ha et al., 2024).

Key criteria in supplier selection include price, quality, delivery time, and service reliability (Asal Safavi, Bahram Sadeghi Bigham, 2024). Notably, three critical factors—product quality, delivery performance, and supplier reputation—are considered fundamental for maintaining a competitive advantage (Teg Alam, 2024); (Masudin et al., 2024). At the same time, integrating sustainability criteria in supplier evaluation is becoming an increasingly important trend, as economic, social, and environmental aspects are carefully considered in the assessment process (Masudin et al., 2024).

Established in 2010, the Sen Hotel System owns three hotels with over 200 rooms. The Sen Grand Hotel & Spa is the newest and most luxurious establishment, featuring 90 rooms. The Sen Luxury Hotel offers 63 rooms, while the Sen Hotel provides 47 rooms. All room categories are equipped with comfortable amenities, premium furnishings, and modern designs, making them suitable for business trips and leisure travel alike.

(Özkan & Koçak, 2024) conducted a study on supplier selection in the cold supply chain for five-star hotels in Antalya, Turkey. This research focuses on identifying key criteria in the procurement process of fresh produce (fruits and vegetables) to ensure quality and operational efficiency. The authors applied the Analytic Hierarchy Process (AHP) to determine the weight of supplier selection criteria and the ELECTRE I method to rank suppliers based on the identified criteria. The results indicate that quality (K1) and delivery performance (K2) are the two most critical criteria, with Supplier 1 being the most suitable choice compared to the other two suppliers. This study contributes to the field of cold supply chain management in the tourism industry, proposing a method that can help hotel businesses optimize their supplier selection process, thereby improving operational efficiency and enhancing customer satisfaction.

(Piya et al., 2022) analyzed green management practices in the hotel industry in the Sultanate of Oman using an integrated Fuzzy AHP-TOPSIS method. It identifies 26 green practice indicators in hotels, categorized into six main criteria: recycling and reuse, transportation, energy efficiency, water conservation, environmental commitment, and green training. The Fuzzy AHP method is applied to determine the weight of these criteria, while Fuzzy TOPSIS is used to calculate green scores and rank hotels accordingly. The findings reveal that "Recycling and Reuse" has the highest weight, whereas "Green Training and Encouragement" has the lowest. Applying the model to four-star and five-star hotels in Oman shows that green scores range from 0.56 to 0.641 (with a 95% confidence level). The study also emphasizes that a hotel's star rating does not necessarily reflect better green practices. This paper contributes to the field of sustainable management by providing a quantitative model that helps hotels assess and improve their green management strategies, thereby enhancing operational efficiency and reducing environmental impact.

(Tajpour et al., 2024) introduced a comprehensive decision-making framework specifically designed for family-owned hotels, focusing on evaluating and selecting suppliers and strategic partners. It places particular emphasis on five-star hotels and parent companies in Iran, ensuring alignment between partners, core values, and operational requirements of the business. By employing a literature analysis approach, combined with fuzzy analysis and the Fuzzy TOPSIS model, the research systematically evaluates multiple critical criteria in the supplier and strategic partner selection process. The framework focuses on key factors such as price competitiveness, product/service quality, reliability and timeliness, flexibility and scalability, communication and responsiveness, after-sales service, business ethics and sustainability, technology and innovation, and compatibility with corporate culture. Integrating these criteria ensures that the framework not only addresses operational needs but also supports the long-term strategic goals of the hotel.

(Vasilakakis & Sdrali, 2023) explored the factors influencing supplier selection in the food and beverage department of the hotel industry in Greece, based on insights from procurement managers. Additionally, it identifies the key factors leading to supplier changes. Through a survey of 653 valid questionnaires, the research identifies six main factor groups affecting supplier selection: raw materials, financial aspects, environmental considerations, service quality, origin and nutritional value, and human factors. Furthermore, three critical factors influencing supplier changes are product and service quality, changes in economic policies, and quality management & food safety systems. These findings help hotel managers in Greece develop effective supply chain management strategies to improve business performance while emphasizing the importance of building strong supplier relationships. By applying exploratory factor analysis (EFA), the study contributes to systematizing and simplifying the approach to supplier selection in the Greek hotel industry.

(Oprasto, 2023) developed a Decision Support System (DSS) to optimize raw material supplier selection for businesses using the Simple Multi-Attribute Rating Technique (SMART). This system facilitates the evaluation and comparison of suppliers based on four key criteria: product quality, delivery time, reliability, and cost. The research process involves normalizing criterion weights, calculating utility values, and determining final scores to rank suppliers. The results indicate that Vendor C achieved the highest score (0.735) and is recommended as the optimal choice, followed by Vendor D (0.588) and Vendor B (0.5). The application of SMART enhances decision-making efficiency, providing objective evaluations based on multiple criteria, thereby optimizing the supply chain and improving business performance.

(Yudhistira et al., 2024) aimed to optimize the supplier selection process by integrating two multi-criteria decision-making (MCDM) methods: Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) and Entropy Weighting. A Decision Support System (DSS) is developed to objectively evaluate suppliers based on key criteria such as price, product quality, delivery time, customer service, and reputation. The Entropy Weighting method is used to determine criterion weights objectively, minimizing subjectivity in the evaluation process, while TOPSIS ranks suppliers based on their proximity to the ideal solution. The results indicate that Supplier US achieved the highest priority score (0.78393), followed by Supplier GH (0.75611) and Supplier FR (0.6913). Applying this integrated model not only enhances decision-making accuracy and transparency but also helps businesses optimize their supply chain and strengthen their competitive advantage.

(Mochamad Iqbal Latif, 2024) proposed a multi-criteria decision-making framework using the Analytical Hierarchy Process (AHP) to evaluate and select raw material suppliers in Indonesia. The evaluation criteria include quality, price, supply quantity, and cultivation area. Using Expert Choice 11 software, the study calculates the weight of each criterion, with quality receiving the highest weight (0.565), indicating that it is the most critical factor in supplier selection. The findings confirm that applying AHP significantly enhances the decision-making process, improves supply chain efficiency, and can be widely adopted in global supply chain management to strengthen operational performance and business resilience.

(Odeyinka et al., 2022) focused on applying the Fuzzy TOPSIS method to select raw material suppliers for a beverage manufacturing company. Due to inconsistencies and unreliability from previous suppliers, the company faced challenges in maintaining production output and sustaining its competitive advantage. Three decision-makers evaluated three sugar suppliers based on eight key criteria, including cost, product value, capability, consistency, risk factors, delivery time, communication ability, and reliability in emergency situations. The results indicate that Supplier 2 achieved the highest closeness coefficient (0.782), making it the optimal choice. The application of Fuzzy TOPSIS enhances the decision-making process, making it more transparent, scientific, and objective, while also improving operational efficiency and strengthening the company’s competitive position.

(Asal Safavi, Bahram Sadeghi Bigham, 2024) proposed a supplier evaluation and selection framework by integrating two multi-criteria decision-making (MCDM) methods: Analytic Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) in a fuzzy environment. AHP is utilized to identify and prioritize key performance indicators (KPIs) such as transportation costs, flexibility, error reduction rate, and effective communication ability. Subsequently, Fuzzy TOPSIS is applied to rank suppliers under uncertainty. The results indicate that Sepidar Darb, Aram Plastic Sabalan, Sanaye Plastic Markaz, and Amin Avar Plastic are the top-performing suppliers, while Pegah Zanjan Company ranks lower. The study also highlights that the COVID-19 pandemic has reshaped supplier selection criteria, shifting the focus from cost and quality alone to adaptability, risk management, and digital integration. By combining traditional and modern evaluation criteria within the AHP-TOPSIS model, this research provides a robust tool for supplier assessment in dynamic supply chain environments.

(Teg Alam, 2024) proposed a supplier selection model using the Analytical Hierarchy Process (AHP) to support businesses in the Al Kharj industrial sector in making strategic decisions. AHP is applied to evaluate suppliers based on both qualitative and quantitative criteria, including quality, price, delivery time, operational history, and risk management. A sensitivity analysis is conducted to test the model's reliability, confirming that AHP enhances transparency and efficiency in supplier selection. The results indicate that Quality Supplier Corporation is the optimal supplier. The study highlights the importance of integrating quantitative analysis methods into strategic decision-making, helping businesses reduce raw material costs and maintain a competitive advantage.

(Masudin et al., 2024) proposed a sustainable supplier evaluation framework by integrating two multi-criteria decision-making (MCDM) methods: Analytic Network Process (ANP) and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). Initially, the research identifies 21 criteria from previous studies and refines them down to 17 key criteria related to three main aspects: economic, environmental, and social. The results indicate that the economic criterion holds the highest weight (0.0652), followed by the social criterion (0.0503) and the environmental criterion (0.0343). The most critical factors in supplier evaluation include consistent product quality, competitive pricing, recyclability, on-time delivery performance, and effective waste management. The study emphasizes that integrating ANP and TOPSIS optimizes the sustainable supplier selection process, enabling businesses to enhance supply chain efficiency and strengthen their competitive advantage in the context of sustainable development.

OBJECTIVES

This study is designed to evaluate and identify the most suitable supplier of convenience items for SEN Grand Hotel & Spa, located in Hanoi, Vietnam, using the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method. The main objectives of this research include:

(i) Identifying the key criteria for supplier selection, such as service quality, delivery time, cost, reliability, and environmental sustainability;

(ii) Applying the TOPSIS method to rank and select the most appropriate supplier based on these criteria;

(iii) Proposing an objective, systematic decision-making approach to optimize the supply chain management and improve the overall quality of services at the hotel.

Through this process, the study aims to provide a comprehensive, data-driven methodology that helps in enhancing the procurement efficiency at SEN Grand Hotel & Spa, while ensuring the sustainability and quality of the hotel's service offerings.

METHODS

This study employs the TOPSIS method to select an amenities supplier for SEN Grand Hotel and Spa, Hanoi, Vietnam. A decision-making panel consisting of six experts with experience in the hospitality and restaurant industry (D_t, t = 1,…,6) is responsible for evaluating m=5 suppliers (A_i, i = 1,…,5) based on n=5 criteria (C_j, j = 1,…,5). The evaluation scores of the amenities suppliers according to each criterion, as well as the weights of the criteria, are expressed using linguistic variables and represented in the form of triangular fuzzy numbers.

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Step 1: Identifying the Criteria for Evaluating Amenities Suppliers

Based on a comprehensive review of relevant studies, the author proposes key factors to be analyzed in this research to aid in the selection of an amenities supplier for SEN Grand Hotel and Spa, Hanoi, Vietnam. The details are presented in the following table:

Table 1: Summary of Evaluation Criteria

STT	Criterion	Explanation	Source
1	Service Quality	**Service quality can be evaluated through:** Customer ratings, response and complaint resolution rate, error or complaint rate, etc.	Özkan & Koçak, 2024, Tajpour et al., 2024, Vasilakakis & Sdrali, 2023, Yudhistira et al., 2024, Teg Alam, 2024, Odeyinka et al., 2022, Mochamad Iqbal Latif, 2024), Oprasto, 2023
2	**Delivery Time**	**Delivery Time can be evaluated through:** Average time from order placement to receipt, on-time delivery rate, late delivery rate, and customer satisfaction with delivery speed, etc.	Özkan & Koçak, 2024 Vasilakakis & Sdrali, 2023 Oprasto, 2023 Odeyinka et al., 2022 Yudhistira et al., 2024 Teg Alam, 2024
3	**Price**	**Pricing can be evaluated through:** Average price compared to competitors, cost-to-value ratio, percentage of customers willing to pay a premium for better quality, and price fluctuation over time, etc.	Tajpour et al., 2024 Vasilakakis & Sdrali, 2023 Oprasto, 2023 Odeyinka et al., 2022 Mochamad Iqbal Latif, 2024 Yudhistira et al., 2024 Teg Alam, 2024
4	**Reliability**	**Reliability can be evaluated through:** Order/service success rate, error or service disruption rate, response and issue resolution time, and customer loyalty level, etc.	Oprasto, 2023, Odeyinka et al., 2022, Vasilakakis & Sdrali, 2023, Yudhistira et al., 2024
5	**Environmental Friendliness**	**Environmental Friendliness can be evaluated through:** CO_2 emissions per product/service, energy consumption during production/delivery, environmental certifications, etc.	Masudin et al., 2024, Tajpour et al., 2024, Vasilakakis & Sdrali, 2023, Piya et al., 2022

Step 2: Determining the Weight of Each Criterion

To determine the weight of each criterion, linguistic variables and the weights of the criteria are expressed in the form of triangular fuzzy numbers.

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Step 3: Calculating the Average Ratio of Choices Based on Each Criterion

Let $x_{ijt} = (e_{ijt}, f_{ijt}, g_{ijt})$ with i = 1,... m, j = 1,..., h and t = 1,..., k represent the evaluation score for each alternative A_i with the user group U_t and criterion C_j. The average evaluation score $x_{ij} = (e_{ij}, f_{ij}, g_{ij})$ is calculated as follows:

$$x_{ij} = \frac{1}{k} \times (x_{ij1} + x_{ij2} + ... + x_{ijt} + ... + x_{ijk}) \quad (1)$$

with, $e_{ij} = \frac{1}{k}\sum_{t=1}^{k} e_{ijt}$, $f_{ij} = \frac{1}{k}\sum_{t=1}^{k} f_{ijt}$, và $g_{ij} = \frac{1}{k}\sum_{t=1}^{k} g_{ijt}$

Let $w_{jt} = (o_{jt}, p_{jt}, q_{jt})$, $w_{jt} \in R^*, j = 1,...,h, t = 1,...,k$ is the importance determined by the user group U_t with criterion C_j. Average Importance $w_j = (o_j, p_j, q_j)$ of criterion C_j is evaluated by k user groups and determined as follows:

$$w_j = \frac{1}{k} \times (w_{j1} + w_{j2} + ... + w_{jk}) \quad (2)$$

with, $o_j = \frac{1}{k}\sum_{t=1}^{k} o_{it}, p_j = \frac{1}{k}\sum_{t=1}^{k} p_{jt}, q_j = \frac{1}{k}\sum_{t=1}^{k} q_{jt}$.

Step 4: Standardizing the Representation of Choices with Objective Criteria

Assume that $r_{ij} = (a_{ij}, b_{ij}, c_{ij})$ **is the representation of choice** i **on criterion** j. Value x_{ij} when standardized, takes the form:

$$x_{ij} = (\frac{a_{ij}}{c_j^*}, \frac{b_{ij}}{c_j^*}, \frac{c_{ij}}{c_j^*}), j \in B$$

$$x_{ij} = (\frac{\bar{a}_j}{c_{ij}}, \frac{\bar{a}_j}{b_{ij}}, \frac{\bar{a}_j}{a_{ij}}), j \in C$$

with $\bar{a}_j = \min_i a_{ij}, c_j^* = \max_i c_{ij}, i = 1,...,m, j = 1,...,n.$

Step 5: Calculate the Importance of the Standardized Norm

The importance of the standardized norm G, is calculated by multiplying the standardized average norm x_{ij} multiply by the importance w_{jt}.

$$G_j = x_{ij} \times w_j, i = 1,...,m, j = 1,...,n \quad (3)$$

Step 6: Calculate A^+, A^-, d_i^+, d_i^-.

Optimal Fuzzy Solution – Positive (FPIS, A^+) and Optimal Fuzzy Solution – Negative (FNIS, A^-) is calculated as follows:

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$$A^+ = (1;1;1)$$
$$A^- = (0;0;0)$$

The distance from each option $A_i, i = 1,...,m$ A^+ and A^- is calculated as follows:

$$d_i^+ = \sqrt{\sum_{j=1}^{n}(G_i - A^+)^2}$$
$$d_i^- = \sqrt{\sum_{j=1}^{n}(G_i - A^-)^2} \quad (4)$$

With d_i^+ represents the shortest distance of the choice A_i, and d_i^- represents the longest distance of the choice A_i.

Step 7: Calculate the Closeness Coefficient and Determine the Ranking Order of the Choices Based on the Closeness Coefficient

The closeness coefficient of each choice is typically used to determine the ranking order of all choices and is calculated as follows:

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-} \quad (5)$$

The higher the closeness coefficient, the closer the choice is to the Positive Ideal Solution (PIS) and the farther it is from the Negative Ideal Solution (NIS).

RESULTS

Step 1: Identifying the Evaluation Criteria for Amenities Suppliers

The evaluation criteria for selecting amenities suppliers include C1: Service Quality, C2: Delivery Time, C3: Price, C4: Reliability, and C5: Environmental Friendliness. The suppliers being evaluated are A1: Horecas, A2: TNS Ecomenities, A3: Haloyal, A4: Nanomex, and A5: Tân Định.

Step 2: Determining the Weight of Each Criterion

After establishing the evaluation criteria for amenities suppliers, each member of the decision-making committee determines the importance of the criteria using linguistic variables. The decision-makers are denoted as D1, D2, D3, D4, D5, and D6. The weight of each criterion is determined through the following table.

By applying equation (2), we obtain the following table:

Table 2: Weights and weighted average values of the criteria

Criterion	**The board makes decisions**						**Aggregated fuzzy number**
	D1	D2	D3	D4	D5	D6	
C1	VI	VI	VI	VI	I	VI	(0.783, 0.883, 0.983)
C2	I	I	I	VI	VI	I	(0.733, 0.833, 0.933)
C3	VI	VI	I	VI	I	I	(0.750, 0.850, 0.950)
C4	I	I	N	I	I	N	(0.567, 0.700, 0.833)

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C5	N	VI	I	I	VI	I	(0.667, 0.783, 0.900)

Source: Model running results

Step 3: Determining the Average Ratio of Choices Based on Each Criterion

In this step, experts D1, D2, D3, D4, D5, and D6 will evaluate the five suppliers - A1: Horecas, A2: TNS Ecomenities, A3: Haloyal, A4: Nanomex, and A5: Tân Định - based on the selected criteria. By applying equation (1), we obtain the following table.

Table 3: Average Ratio Values of Choices Based on Each Criterion

		D1	**D2**	**D3**	**D4**	**D5**	**D6**	**Average ratio**
C1 Service Quality	A1	G	F	VG	G	F	G	(0.500, 0.700, 0.883)
	A2	G	G	VG	G	F	G	(0.533, 0.733, 0.917)
	A3	F	F	F	VG	G	G	(0.433, 0.633, 0.817)
	A4	G	G	F	F	G	F	(0.367, 0.567, 0.767)
	A5	VG	G	VG	G	VG	G	(0.567, 0.767, 0.933)
C2 Delivery Time	A1	G	F	G	G	G	G	(0.467, 0.600, 0.800)
	A2	G	VG	VG	G	G	G	(0.567, 0.767, 0.900)
	A3	F	F	L	L	F	VL	(0.183, 0.367, 0.550)
	A4	G	G	G	F	G	F	(0.433, 0.633, 0.833)
	A5	F	G	VG	G	VG	G	(0.533, 0.733, 0.900)
C3 Price	A1	60	60	60	60	60	60	(1.000, 1.000, 1.000)
	A2	62	62	62	62	62	62	(0.968, 0.968, 0.968)
	A3	62	62	62	62	62	62	(0.968, 0.968, 0.968)
	A4	61	61	61	61	61	61	(0.984, 0.984, 0.984)
	A5	59	59	59	59	59	59	(1.017, 1.017, 1.017)
C4 Reliability	A1	G	F	F	VG	F	G	(0.433, 0.633, 0.817)
	A2	F	G	L	F	G	F	(0.333, 0.533, 0.733)
	A3	L	G	L	F	G	F	(0.300, 0.500, 0.700)
	A4	G	F	F	G	G	F	(0.400, 0.600, 0.800)
	A5	VG	VG	G	G	VG	G	(0.600, 0.800, 0.950)
C5 Environmental Friendliness	A1	F	F	G	G	G	G	(0.433, 0.633, 0.833)
	A2	VG	VG	F	G	F	VG	(0.533, 0.733, 0.883)
	A3	G	G	VG	VG	G	G	(0.567, 0.767, 0.933)
	A4	G	G	F	G	F	G	(0.433, 0.633, 0.833)
	A5	VG	VG	G	VG	G	G	(0.600, 0.800, 0.950)

Source: Model running results

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Step 4: Standardizing the Representation of Choices with Objective Criteria

Table 4: Standardized Values of Choices with Criteria

		D1			D2			D3			D4			D5			D6		
C1	A1	0.5	0.7	0.9	0.3	0.5	0.7	0.7	0.9	1	0.5	0.7	0.9	0.5	0.7	0.9	0.5	0.7	0.9
	A2	0.5	0.7	0.9	0.5	0.7	0.9	0.7	0.9	1	0.5	0.7	0.9	0.5	0.7	0.9	0.5	0.7	0.9
	A3	0.3	0.5	0.7	0.3	0.5	0.7	0.3	0.5	0.7	0.7	0.9	1	0.5	0.7	0.9	0.5	0.7	0.9
	A4	0.5	0.7	0.9	0.5	0.7	0.9	0.3	0.5	0.7	0.3	0.5	0.7	0.3	0.5	0.7	0.3	0.5	0.7
	A5	0.7	0.9	1	0.5	0.7	0.9	0.7	0.9	1	0.5	0.7	0.9	0.5	0.7	0.9	0.5	0.7	0.9
C2	A1	0.5	0.3	0.5	0.3	0.5	0.7	0.5	0.7	0.9	0.5	0.7	0.9	0.5	0.7	0.9	0.5	0.7	0.9
	A2	0.5	0.7	0.7	0.7	0.9	1	0.7	0.9	1	0.5	0.7	0.9	0.5	0.7	0.9	0.5	0.7	0.9
	A3	0.3	0.5	0.7	0.3	0.5	0.7	0.1	0.3	0.5	0.1	0.3	0.5	0.3	0.5	0.7	0	0.1	0.2
	A4	0.5	0.7	0.9	0.5	0.7	0.9	0.5	0.7	0.9	0.3	0.5	0.7	0.5	0.7	0.9	0.3	0.5	0.7
	A5	0.3	0.5	0.7	0.5	0.7	0.9	0.7	0.9	1	0.5	0.7	0.9	0.7	0.9	1	0.5	0.7	0.9
C3	A1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	A2	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
	A3	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
	A4	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
	A5	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
C4	A1	0.5	0.7	0.9	0.3	0.5	0.7	0.3	0.5	0.7	0.7	0.9	1	0.3	0.5	0.7	0.5	0.7	0.9
	A2	0.3	0.5	0.7	0.5	0.7	0.9	0.1	0.3	0.5	0.3	0.5	0.7	0.5	0.7	0.9	0.3	0.5	0.7
	A3	0.1	0.3	0.5	0.5	0.7	0.9	0.1	0.3	0.5	0.3	0.5	0.7	0.5	0.7	0.9	0.3	0.5	0.7
	A4	0.5	0.7	0.9	0.3	0.5	0.7	0.3	0.5	0.7	0.5	0.7	0.9	0.5	0.7	0.9	0.3	0.5	0.7
	A5	0.7	0.9	1	0.7	0.9	1	0.5	0.7	0.9	0.5	0.7	0.9	0.7	0.9	1	0.5	0.7	0.9
C5	A1	0.3	0.5	0.7	0.3	0.5	0.7	0.5	0.7	0.9	0.5	0.7	0.9	0.5	0.7	0.9	0.5	0.7	0.9
	A2	0.7	0.9	1	0.7	0.9	1	0.3	0.5	0.7	0.5	0.7	0.9	0.3	0.5	0.7	0.7	0.9	1
	A3	0.5	0.7	0.9	0.5	0.7	0.9	0.7	0.9	1	0.7	0.9	1	0.5	0.7	0.9	0.5	0.7	0.9
	A4	0.5	0.7	0.9	0.5	0.7	0.9	0.3	0.5	0.7	0.5	0.7	0.9	0.3	0.5	0.7	0.5	0.7	0.9
	A5	0.7	0.9	1	0.7	0.9	1	0.5	0.7	0.9	0.7	0.9	1	0.5	0.7	0.9	0.5	0.7	0.9

Source: Model running results

Step 5: Calculating the Importance of the Standardized Norm
By applying equation (3), we obtain the following table:

Table 5: Average Evaluation Ratio of Suppliers Based on Each Criterion

Criterion	Supplier	The board makes decisions								
		D1	D2	D3	D4	D5	D6	R_{ij}		
	A_1	G	F	VG	G	F	G	0.392	0.618	0.869

	A_2	G	G	VG	G	F	G	0.418	0.648	0.901
C1	A_3	F	F	F	VG	G	G	0.339	0.559	0.803
	A4	G	G	F	F	G	F	0.287	0.500	0.754
	A5	VG	G	VG	G	VG	G	0.444	0.677	0.918
	A_1	G	F	G	G	G	G	0.342	0.500	0.747
C2	A_2	G	VG	VG	G	G	G	0.415	0.639	0.840
	A_3	F	F	L	L	F	VL	0.134	0.305	0.513
	A4	G	G	G	F	G	F	0.318	0.528	0.778
	A5	F	G	VG	G	VG	G	0.391	0.611	0.840
	A_1	60	60	60	60	60	60	0.750	0.850	0.950
	A_2	62	62	62	62	62	62	0.726	0.823	0.919
C3	A_3	62	62	62	62	62	62	0.726	0.823	0.919
	A4	61	61	61	61	61	61	0.738	0.836	0.934
	A5	59	59	59	59	59	59	0.763	0.864	0.966
	A_1	G	F	F	VG	F	G	0.246	0.443	0.681
	A_2	F	G	L	F	G	F	0.189	0.373	0.611
C4	A_3	L	G	L	F	G	F	0.170	0.350	0.583
	A4	G	F	F	G	G	F	0.227	0.420	0.667
	A5	VG	VG	G	G	VG	G	0.340	0.560	0.792
	A_1	F	F	G	G	G	G	0.289	0.496	0.750
	A_2	VG	VG	F	G	F	VG	0.356	0.574	0.795
C5	A_3	G	G	VG	VG	G	G	0.378	0.600	0.840
	A4	G	G	F	G	F	G	0.289	0.496	0.750
	A5	VG	VG	G	VG	G	G	0.400	0.626	0.855

Source: Model running results

Step 6: Calculation A^+, A^-, d_i^+, d_i^-.

The study selects the optimal fuzzy solutions A+ and A- as shown in the table. The formula is used to calculate the distance of each choice from the optimal solution.

Table 6: Optimal Fuzzy Solution

A^+	1	1	1
A^-	0	0	0

Step 7: Calculate the Closeness Coefficient and Determine the Ranking Order of Choices Based on the Closeness Coefficient

By applying formulas (4) and (5) for calculation, we obtain the following table:

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Table 7: Distance and Closeness Coefficient

Supplier	d^+	d_-	Tight coefficient	Ranking
Horecas	0.7558	1.0675	0.58550	3
TNS Ecomenities	0.7222	1.101	0.60389	2
Haloyal	0.8475	0.9674	0.53303	5
Nanomex	0.8012	1.0248	0.56123	4
Tân Định	0.6401	1.1952	0.65122	1

Source: Model running results

Based on the ranking of suppliers, SEN Grand Hotel and Spa can prioritize the selection of amenities suppliers in the following order: Tân Định, TNS Ecomenities, Horecas, Nanomex, and Haloyal.

DISCUSSION

This study has demonstrated the applicability of the TOPSIS method in selecting amenities suppliers for hotels, helping to minimize subjectivity and ensure data-driven decision-making. The findings not only assist SEN Grand Hotel & Spa in optimizing its procurement process but also contribute to the sustainable supply chain management trend in the hospitality industry.

Integrating criteria such as sustainability and reliability into supplier evaluation is becoming increasingly important, especially as the tourism industry shifts towards environmentally friendly solutions. In the future, this research can be expanded by incorporating additional factors, such as customer experience evaluations, or by applying a combined AHP-TOPSIS model to enhance the accuracy of supplier rankings.

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