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Vendor Selection in the Cosmetic Industry using Analytics Hierarchy Process (A Case Study of Saejiva Company)

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ABSTRACT: The Indonesian fragrance industry, under the cosmetic industry, is growing, with an increasing income per capita in the perfume category, despite a dip in 2020. The global natural fragrance market, growing at an estimated 9% CAGR from 2023 to 2032, shows a strong preference for essential oil-based fragrances. Essential oils, derived from natural plant parts, are costly to produce due to large-scale machinery, skilled labor, and environmental factors. Companies often outsource these aspects to reduce costs and focus on core competencies like marketing and sales. Saejiva, a natural fragrance brand, currently faces challenges in vendor selection, experiencing issues with inefficiency, delays, and poor product quality from previous vendors, has the effect of reducing potential profits and necessitating a reevaluation of their vendor choices. This study uses the Analytical Hierarchy Process (AHP) to help Saejiva select a new vendor by prioritizing criteria that meet the company's requirements and recommending the best vendor. Data was collected through literature reviews to identify relevant criteria, Focus Group Discussions (FGD) to find essential criteria for the company, and AHP questionnaires. Saejiva's C-level executives acted as experts in the FGDs and AHP questionnaires to determine criteria priorities and vendor alternatives. The results showed the importance levels of criteria as follows: capability (0.3668), quality (0.1848), cost (0.1382), service (0.1068), capacity (0.0654), delivery (0.0606), warranty (0.0525), and performance history (0.0249). The importance levels of vendor alternatives were SKI (3.1994), AVF (2.7415), and SHB (2.0591). Thus, the best vendor recommended for Saejiva is SKI as the next vendor.

KEYWORDS: Analytics hierarchy process, Cosmetic, Fragrance, Outsourcing, Vendor selection.

INTRODUCTION

The Indonesian fragrance industry, under the cosmetic industry, is predicted to continue growing, with Statista Search Department (2023) indicating an increasing trend in total income per capita in the perfume product category from 2015 to the present, except for a dip in 2020. In the other side, there growth rate of the global natural fragrance market is higher compared to the synthetic fragrance market which growing at an estimated 9% CAGR from 2023 to 2032 (Pulidindi & Ahuja, 2023), reflects this preference indicating a strong market interest in essential oil-based fragrances. Essential oils used in fragrances are derived from natural plant part through various extraction processes, which are costly due to the need for large-scale machinery, skilled labor, and susceptibility to weather and environmental changes (Sarkic & Stappen, 2018; Manina & Forlani, 2023). Companies often address their limited capacity to manage these aspects by outsourcing, transferring in-house activities to external vendors through subcontracting (Agburu et al., 2017), which can reduce production costs and allow firms to focus on core competencies such as marketing and sales (Berggren & Bengtsson, 2004). However, the success of outsourcing depends on selecting the right outsourcing vendor, considering factors like product quality, future development, compliance with technological standards, delivery time, raw material prices, and shipping costs.

Saejiva, a natural fragrance brand, is outsourcing its production to improve product quality and reduce costs. This move allows Saejiva to focus on marketing and sales while cutting production expenses and achieving more efficient business processes. By outsourcing, Saejiva aims to offer high-quality, standardized fragrances at competitive prices, enhancing profitability and strategic goals.

BUSINESS ISSUE

Saejiva has launched its first product, two perfume variants, in October 2023. At the start of production for its first two perfume variants, Saejiva chose a vendor that accepted Essential Oil (EO) formulations and could handle orders for 100 products for each variant, despite limited options. However, this vendor proved inefficient, with long delivery times, poor quality control from vendor

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without any warranty, and delays up to two weeks causing potensial revenue losses of approximately 3.8 million rupiah and damaging the company's reputation. As a new perfume brand, the potential loss of that amount was quite large for it. By considering reputation and product quality more than switching to other third-party outsourcing, Saejiva continues to maintain existing vendors only for the first two variants in this initial batch.

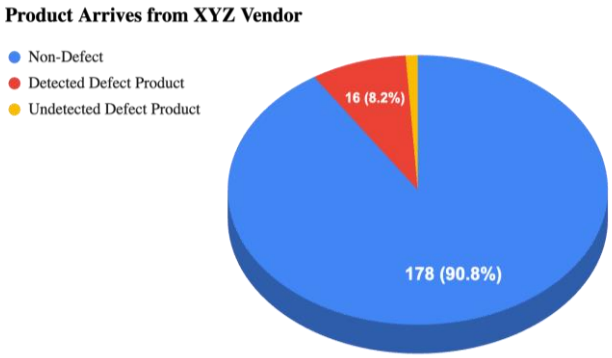

Figure 1: Saejiva Internal Data: Product Arrives from Previous Vendor

Based on internal data from Saejiva which can be seen in the chart above, Saejiva ordered a total of 200 products for the first batch. Sixteen of the products were confirmed as defective after arriving at the Saejiva warehouse, two others were confirmed as defective after the goods arrived at the customer, and the remainder had no defects. These two undetected products caused a decrease in customer reputation, while the total of product defects, which is eighteen products, caused potential losses of 3.8 million rupiah. Saejiva has a plan to launch a new variant soon. On the other side, Saejiva realized that this business issue was directly related to vendor performance and Saejiva lacked control to resolve it. So that, the vendor selection was the root of its outsourcing problems and Saejiva plans to re-evaluate its process to ensure consistent quality, timely delivery, and overall business continuity in its outsourced manufacturing operations which also leads to stable sales revenue.

RESEARCH OBJECTIVE

This research aims to assist Saejiva in selecting the best fragrance outsourcing vendor option for its upcoming production, along with several derivative objectives including to identify all the criteria that influence vendor selection for Saejiva and to determine the most crucial criteria in this process.

LITERATURE REVIEW

A. Outsourcing

Outsourcing involves obtaining consistent services and replacement products from other companies to manage non-core competencies within the supply chain (Wadhwa & Ravindran, 2007). This practice is beneficial because outsourcing vendors can achieve higher production efficiency through economies of scale and accumulated expertise (McIvor, 2008). Consequently, many companies are considering outsourcing, particularly for supply chain procurement and logistics (Wadhwa & Ravindran, 2007).

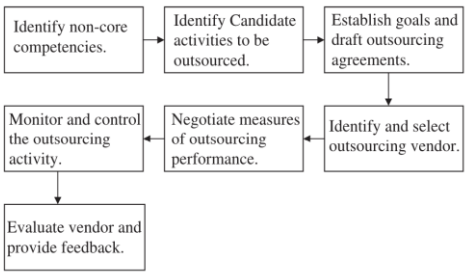

Figure 2: Overview of Outsourcing Process (Wadhwa & Ravindran, 2007)

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Based on the Figure 2, the outsourcing process involves several stages: identifying the company's non-core competencies, determining which activities can be outsourced, setting outsourcing objectives and approvals, selecting vendors, negotiating performance metrics, monitoring and controlling activities, and evaluating vendors (Wadhwa & Ravindran, 2007). Among these stages, selecting vendors is a crucial and potentially error-prone decision that impacts long-term success. The ideal vendor should align with the organization's culture and needs, demonstrating reliability, technical expertise, financial stability, and manufacturing capability (Wadhwa & Ravindran, 2007).

B. Analytic Hierarchy Process

The Analytical Hierarchy Process (AHP) is a method used in Multiple Criteria Decision Making (MCDM) that deals with numerous criteria and alternative options (Saaty, 1980). AHP's purpose is to simplify complex decision problems through a systematic analytical approach, aiding in the identification of preferred alternatives by addressing every potential issue within the hierarchy (Khaira & Dwivedi, 2018). It is utilized in areas operations management, particularly in supply chain management for tasks like supplier selection and evaluation of outsourcing companies (Subramanian & Ramanathan, 2012).

AHP is recognized for its advantages over other methods, including its user-friendliness, effective use of measurement scales, and capability to address complex decision-making issues with multiple criteria and alternatives (Lai et al., 1999). Additionally, it allows for the integration of both quantitative and qualitative measures in the prioritization process through calibration (Vaidya & Kumar, 2006).

C. Previous Research Study

To select suppliers using the Analytical Hierarchy Process, a literature review was conducted to identify the necessary criteria. Sources included research journals focused on vendor selection in the cosmetics and fragrance industry. The most relevant literature is summarized in Table 1.

Table 1: Previous Study Literature

No	Criterion	Zaeri et al., 2011	Vahdani et al., 2012	Roshandel et al., 2013	Ramazanzadeh et al., 2015	Utomo, 2015	Kannan, 2018	Ramadhan & Superman, 2022
1	Performance History		v		v			
2	Cost	v		v	v	v	v	
3	Service		v	v	v	v	v	
4	Quality		v	v		v	v	v
5	R&D Innovation						v	v
6	Flexibility			v			v	
7	Responsiveness		v	v		v		
8	Capacity		v	v				v
9	Capability						v	
10	Reliability	v					v	
11	Delivery	v			v			
12	Warranty	v			v			

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Based on existing literature, twelve criteria for vendor or supplier selection were found that are relevant for companies in the fragrance and cosmetics industry. From these criteria, The Author sharpens each definition of criteria by adding other literature along with the strength of relevance of these criteria to a company, which will then be explained in the Table 2.

Table 2: Criterion Definitions from Previous Study

No	Criterion	Authors	Definitions
1	Performance History	Taherdoost & Brard, 2019 Yücenur et al., 2011	Supplier's track record in financial, economic, social, organizational, and societal areas. It can influence its future performance which become a consideration for companies to work with high-value suppliers.
2	Cost	Taherdoost & Brard, 2019 Yücenur et al., 2011	Cost criterion Includes raw materials, packaging, unit cost, pricing terms, taxes, and discounts. Companies seek low-cost suppliers to maximize profit
3	Service	Taherdoost & Brard, 2019 Yücenur et al., 2011	Supplier's ability to provide intangible products, customization, and communication. The high quality of service provided by suppliers can help increase company/client satisfaction and loyalty.
4	Quality	Taherdoost & Brard, 2019 Stević et al., 2020	Consistency in meeting specifications such as dimensions, design, durability, variety, production quality, and quality system, ensuring products meet company needs.
5	R&D Innovation	Taherdoost & Brard, 2019 Ho et al., 2010	Supplier’s ability to innovate existing products or develop new ones. It is important factor for supplier selection so that they are able to suit company needs.
6	Flexibility	Yücenur et al., 2011	Ability to adapt production schedules, customization options, and order quantities. It is essential for managing urgent and uncertain demands.
7	Responsiveness	Handfield & Bechtel, 2002	Supplier’s effectiveness in responding to customer needs and inquiries. It is crucial for maintaining good relationships.
8	Capacity	Taherdoost & Brard, 2019 Yücenur et al., 2011	Supplier’s ability to produce volume using current resources. Companies tend to choose suppliers with greater capacity.
9	Capability	Taherdoost & Brard, 2019 Patel & Thakar, 2021	Include of supplier’s technical proficiency, ability to adopt new technologies, and resources for product development. Research by Patel & Thakar (2021), the capability factor is the third most important factor to consider in supplier selection
10	Reliability	Yücenur et al., 2011	Supplier’s consistency in keeping promises regarding product conditions. It is one of the considerations in finding the right supplier for the company.
11	Delivery	Taherdoost & Brard, 2019 Yücenur et al., 2011	Supplier's adherence to specified schedules, lead-time, and location, ensuring timely supply chain management. In Company needs a supplier who can manage the supply chain and adhere to delivery schedules on time.
12	Warranty	Taherdoost & Brard, 2019 Yücenur et al., 2011	Supplier’s compliance with warranty and effectiveness of claims policy for product defects. Companies should consider the warranty factor since higher rejection rates for product defects can reduce profitability.

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D. Conceptual Framework

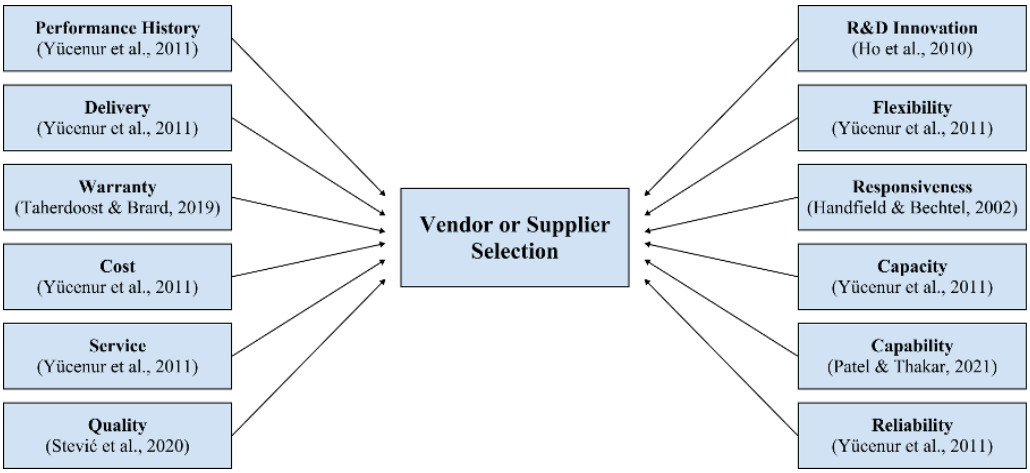

Figure 3: Conceptual Framework

The conceptual framework of this study starts with the dependent variable at the center, which is the focal point of this research: vendor selection. The vendor selection variable will be influenced by independent variables which are also referred to as criteria, which in this research there are twelve independent variables or criteria based on the literature review. These independent variables will also be used in data analysis within the Analytics Hierarchy Process (AHP) framework.

RESEARCH METHODOLOGY

A. Research Design

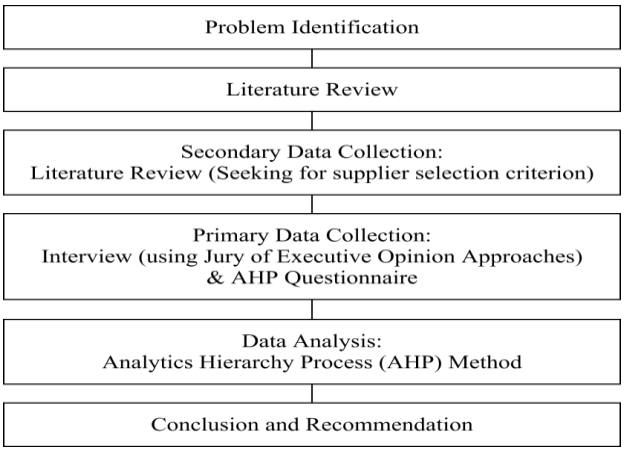

Figure 4: Research Design

The research process began with identifying problems and potential risks within Saejiva, determining which issues to address first and the methods for finding solutions. External research provided a strong evidence base by identifying similar cases in previous studies. The next step involved a root cause analysis to address vendor selection issues, pinpointing underlying problems to improve operations and ensure the selection of the best vendors. A literature review summarized and analyzed existing research on supply chain management, supplier selection, and the Analytics Hierarchy Process (AHP), defining terms and outlining the theoretical basis and application of AHP. Data collection combined qualitative and quantitative approaches, with secondary data obtained from previous studies and primary data gathered through interviews and questionnaires with Saejiva's C-level executives. Focus Group Discussion (FGD) interviews with the Saejiva's C-level executives validated important criteria from previous research, using the jury of executive opinion method to reach a consensus on essential criteria. Following the interviews, a questionnaire was used to

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rank the criteria and determine their importance weight for the AHP analysis process. This comprehensive approach ensured a thorough understanding of the vendor selection process, enabling effective decision-making for Saejiva's business continuity.

B. Data Analysis Method

In this research, Analytics Hierarchy Process (AHP) will be used as a data analysis method to find the most suitable outsource vendor for Saejiva along with its essential criteria. Analytic Hierarchy Process to solve decision problems according to Zahedi (1986) can be done in 4 steps:

1. Structuring the decision problem into a hierarchical model/tree structure: Decision concerns and objectives are organized hierarchically into decision elements, which include criteria and alternative options.
2. Conducting pairwise comparisons and obtaining the judgmental matrix: A questionnaire is distributed among stakeholders to gather opinions for pairwise comparisons. Individual assessments are combined using the geometric mean. The scale ranges from one (equally important) to nine (one element is significantly more important).

Table 3: Pairwise Comparisons Scaling Score

Importance Scale	1	3	5	7	9	2, 4, 6, 8
Interpretation	Equally Important Preferred	Moderately Important Preferred	Strongly Important Preferred	Very Strongly Important Preferred	Extremely Important Preferred	Intermediate values between 2 adjacent judgments.

3. Verifying the local weight and consistency of comparisons: Expert judgment weights are paired, and the geometric mean is used to compute each comparison criterion. The column matrix is summed, and the priority value is calculated by dividing the row matrix sum by the number of criteria. The consistency ratio (CR) is calculated by dividing the consistency index (CI) by the random index (RI). Each required formula is listed in the figures below, including the random index (RI) value which is also listed in table 4.

$$\lambda_{max} = \frac{Eigenvector_1 + Eigenvector_2 + ... + Eigenvector_n}{n}$$

Figure 5: Principal Eigenvalue Formula

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

Figure 6: Consistency Index Formula

$$CR = \frac{CI}{RI}$$

Figure 7: Consistency Ratio Formula

Table 4: The Value of Random Consistency Index (Golden and Wang, 1989)

Size of Metrics (n)	**RI**	**Size of Metrics (n)**	**RI**
1	0	**6**	1.24
2	0	**7**	1.33
3	0.58	**8**	1.40
4	0.90	**9**	1.45
5	1.12	**10**	1.50

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4. Aggregating the weights across various levels to obtain the final weights of alternatives: Once the CR meets the acceptable value, the final step is to calculate the weight of each alternative compared to each criterion using the same method as in the previous step through expert judgment. Next, the best alternative will be found and can achieve the objectives of this research.

RESULT AND DISCUSSION

A. Alternative Candidate Selection

Table 5: Outsourcing Vendor Candidate Selection

No	Vendor Initial	Able Using Essential Oil as a Based	MOQ level in 300	Sample before Deal Agreement	Candidate Approval
1	AVF	v	v	v	Approved
2	SHB	v	v	v	Approved
3	KGI	v			Not Approved
4	JHL		v	v	Not Approved
5	FMI	v		v	Not Approved
6	MGK		v	v	Not Approved
7	BLN		v		Not Approved
8	SCL		v	v	Not Approved
9	NCI			v	Not Approved
10	JLT	v	v		Not Approved
11	SKI	v	v	v	Approved
12	IGC		v	v	Not Approved
13	AML		v	v	Not Approved

Saejiva must select a fragrance manufacturing vendor that meets its minimum criteria: using essential oil, a Minimum Order Quantity (MOQ) of 300 pieces, and the ability to produce samples before a deal. Out of 13 contacted vendors, three met these criteria: **AVF, SHB, and SKI**. These vendors will be evaluated further to determine the best fit for Saejiva through the methods adopted in this research.

B. Criteria Validation

In the first cycle of FGD interviews using jury of executive opinion approach, the general consensus was to keep performance history, cost, service, quality, capacity, and capability as independent criteria. The experts agreed to combine flexibility, responsiveness, and reliability under service criteria, and to integrate R&D innovation into capability criteria. However, there was disagreement on the delivery and warranty criteria. The first expert suggested combining delivery with service and warranty with capability, while the other two experts felt these criteria should remain separate. No criteria were removed, but delivery and warranty still require further discussion to reach a consensus. To resolve these differences, the second cycle of FGD interviews will confirm and align each expert's definitions to create a unified set of criteria for Saejiva.

In general, a joint consensus was found after conducting the second cycle of FGD interviews, a consensus was reached to include delivery and warranty as independent criteria. This brought the total agreed criteria to eight: **performance history, cost, service, quality, capacity, capability, delivery, and warranty**. Other criteria were combined under these selected categories, which will be detailed in the definitions of each criterion.

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Table 6: Criteria Definitions from Expert

No	Criterion Selected	Previous Research Authors	Expert Definition (in Saejiva and cosmetic industry context)
1	Performance history	Taherdoost & Brard, 2019 Yücenur et al., 2011	The past performance and inside industry reputation
2	Cost	Taherdoost & Brard, 2019 Yücenur et al., 2011	The expenses for raw materials, packaging, delivery, sampling, and other associated costs
3	Service	Taherdoost & Brard, 2019 Yücenur et al., 2011	The vendor's customer service, responsiveness, flexibility, and problem resolution and urgent handling ability.
4	Quality	Taherdoost & Brard, 2019 Stević et al., 2020	The product standards like perfume aroma, projection, longevity, consistency, raw material safety, regulatory compliance, and overall excellence
5	Capacity	Taherdoost & Brard, 2019 Yücenur et al., 2011	The vendor's ability to meet order volumes, scale production, launch new product lines, and handle large-scale orders without delays
6	Capability	Taherdoost & Brard, 2019 Patel & Thakar, 2021	The R&D innovation, technical skills, distinctive fragrance creation, and advanced production techniques
7	Delivery	Taherdoost & Brard, 2019 Yücenur et al., 2011	The specified delivery schedules, lead-time, on-time performance, and vendor location
8	Warranty	Taherdoost & Brard, 2019 Yücenur et al., 2011	The guarantees on defective products and the effectiveness of the claims policy for product defects

C. Analytics Hierarchy Process Method

1. Hierarchial Model / Decision Tree:

After gathering data, three vendor alternatives and eight selection criteria were identified to determine the best vendor for Saejiva. A hierarchical model will be created with the first level at the top is intended as a goal, the second level in the middle is intended as criteria to be considered, and the third level at the bottom is intended as alternative existing vendors.

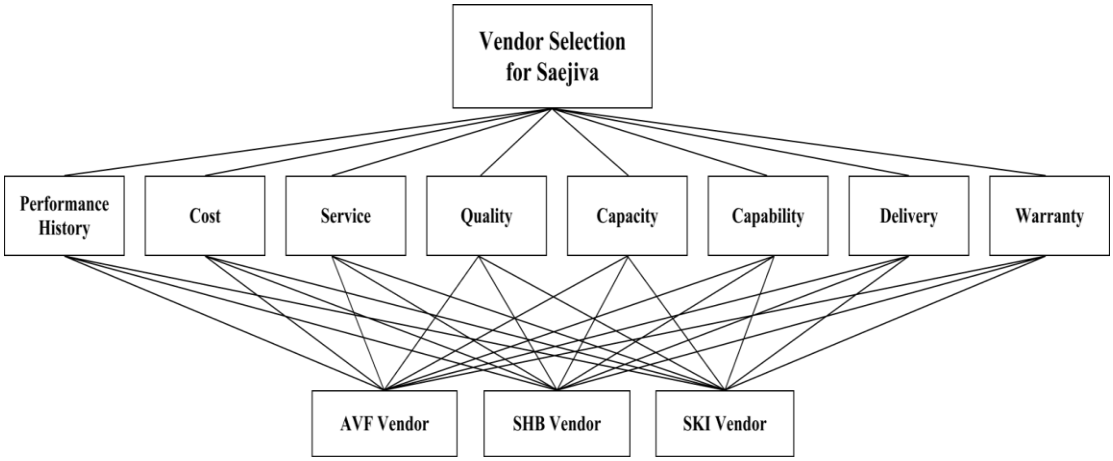

Figure 8: Decision Tree Model

2. Criteria Weighting Calculation and Consistency Checking:

Data from the AHP questionnaire filled out by Saejiva's three executives will be used to calculate the weight of each criterion. Experts rated each criterion using a pairwise comparison scale from 1 to 9. The author will combine the data, assuming each expert's input has an equal weight ratio of 1:1:1, before proceeding to the next AHP step.

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Table 7: Criteria Calculation

Geomean matrix								
	Performance History	**Cost**	**Service**	**Quality**	**Capacity**	**Capability**	**Delivery**	**Warranty**
Performance History	1.00	0.18	0.21	0.16	0.31	0.12	0.28	0.35
Cost	5.52	1.00	0.94	0.55	2.88	0.26	3.30	3.42
Service	4.72	1.06	1.00	0.55	1.82	0.24	1.71	1.91
Quality	6.21	1.82	1.82	1.00	2.88	0.35	3.91	3.91
Capacity	3.17	0.35	0.55	0.35	1.00	0.18	1.26	1.44
Capability	8.28	3.91	4.12	2.88	5.65	1.00	5.31	5.81
Delivery	3.56	0.30	0.58	0.26	0.79	0.19	1.00	1.26
Warranty	2.88	0.29	0.52	0.26	0.69	0.17	0.79	1.00
Normalized								
Performance History	0.0283	0.0203	0.0217	0.0268	0.0196	0.0483	0.0160	0.0181
Cost	0.1561	0.1121	0.0965	0.0917	0.1799	0.1021	0.1879	0.1790
Service	0.1335	0.1192	0.1026	0.0917	0.1133	0.0969	0.0973	0.1001
Quality	0.1758	0.2038	0.1864	0.1666	0.1799	0.1385	0.2228	0.2049
Capacity	0.0898	0.0389	0.0564	0.0577	0.0624	0.0708	0.0717	0.0755
Capability	0.2342	0.4390	0.4227	0.4805	0.3521	0.3995	0.3023	0.3040
Delivery	0.1006	0.0340	0.0600	0.0425	0.0495	0.0752	0.0569	0.0659
Warranty	0.0816	0.0328	0.0536	0.0425	0.0432	0.0688	0.0452	0.0523
Priority Vector	**0.0249**	**0.1382**	**0.1068**	**0.1848**	**0.0654**	**0.3668**	**0.0606**	**0.0525**

In order to find the geometric mean normalized weight pairwise comparison, each cell in the matrix needs to be divided by the total of its column values. The normalized weight of each cell compared to its column is then determined. The priority vector for each criterion is found by averaging the geometric mean weight value for each row. The final priority scores determine the ranking of the criteria among the eight alternatives later. Next, in order to obtain acceptable calculation results, it is necessary to check the consistency of the matrix first. Meanwhile, Saaty (1980) found that an acceptable consistency ratio is below or equal to 0.1. Where the consistency ratio can be found by dividing the consistency index by the random index, with the consistency index obtained from the existing formula after getting the principal eigenvalue.

Table 8: Criteria Consistency Checking

Terms	**Principal Eigen Value (λmax)**	**Consistency Index (CI)**	**Random Index (RI) for matrix of 8**	**Consistency Ratio (CR)**
Formula	$(\lambda 1+...+\lambda n) / n$	$(\lambda max - n) / (n-1)$	**theoretical value*	*CI / RI*
Results	**8.21**	**0.03**	**1.40**	**0.0216**

The Consistency Ratio (CR) in this AHP matrix was calculated to be 0.0216, which is below the threshold of 0.1. Therefore, the geometric mean criterion comparison matrix is considered consistent (0.0216 < 0.1) and suitable for achieving the objectives of the AHP method.

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3. ***Alternative Weighting Calculation and Consistency Checking:***
Experts assessed alternatives through a pairwise comparison questionnaire, rating each on a scale from 1 to 9. The three alternatives evaluated were AVF, SHB, and SKI. Each expert reviewed product samples, company profiles, and relevant details such as price, production timelines, and facilities provided where the information is obtained directly from the vendor after contacting them. Each expert carries out a pairwise comparison on each criterion, which is then summarized into one joint assessment using geomean calculations. Similar to the criteria pairwise comparison, each expert's assessments are given equal weight, with a ratio of 1:1:1.

Table 9: Alternative Calculation and Consistency Checking

		Geomean matrix			Normalized			Priority Vector	Eigen-vector	Consistency Checking		
		AVF	SHB	SKI	AVF	SHB	SKI			λmax	CI	CR
Performance History	AVF	1.00	2.88	0.69	0.36	0.43	0.34	0.3749	3.0175	3.0149	0.0075	0.0129
	SHB	0.35	1.00	0.35	0.12	0.15	0.17	0.1473	3.0065			
	SKI	1.44	2.88	1.00	0.52	0.43	0.49	0.4778	3.0208			
Cost	AVF	1.00	2.88	3.63	0.62	0.63	0.60	0.6149	3.0037	3.0020	0.0010	0.0018
	SHB	0.35	1.00	1.44	0.21	0.22	0.24	0.2232	3.0014			
	SKI	0.28	0.69	1.00	0.17	0.15	0.16	0.1619	3.0010			
Service	AVF	1.00	0.63	0.37	0.19	0.22	0.17	0.1923	3.0061	3.0104	0.0052	0.0089
	SHB	1.59	1.00	0.79	0.30	0.35	0.37	0.3375	3.0102			
	SKI	2.71	1.26	1.00	0.51	0.44	0.46	0.4702	3.0149			
Quality	AVF	1.00	3.30	0.63	0.35	0.45	0.32	0.3715	3.0361	3.0305	0.0153	0.0263
	SHB	0.30	1.00	0.32	0.10	0.13	0.16	0.1349	3.0119			
	SKI	1.59	3.11	1.00	0.55	0.42	0.51	0.4937	3.0435			
Capacity	AVF	1.00	2.88	1.26	0.47	0.44	0.48	0.4625	3.0028	3.0020	0.0010	0.0018
	SHB	0.35	1.00	0.38	0.16	0.15	0.14	0.1534	3.0009			
	SKI	0.79	2.62	1.00	0.37	0.40	0.38	0.3841	3.0024			
Capability	AVF	1.00	1.10	0.35	0.21	0.22	0.20	0.2114	3.0007	3.0010	0.0005	0.0009
	SHB	0.91	1.00	0.35	0.19	0.20	0.20	0.1983	3.0006			
	SKI	2.88	2.88	1.00	0.60	0.58	0.59	0.5903	3.0018			
Delivery	AVF	1.00	0.35	1.26	0.21	0.20	0.25	0.2231	3.0066	3.0095	0.0047	0.0082
	SHB	2.88	1.00	2.71	0.62	0.58	0.55	0.5818	3.0165			
	SKI	0.79	0.37	1.00	0.17	0.21	0.20	0.1952	3.0053			
Warranty	AVF	1.00	2.29	0.69	0.35	0.39	0.33	0.3577	3.0090	3.0081	0.0041	0.0070
	SHB	0.44	1.00	0.40	0.15	0.17	0.19	0.1712	3.0041			
	SKI	1.44	2.52	1.00	0.50	0.43	0.48	0.4710	3.0113			

In accordance with the eight matrix representing the eight existing criteria, the consistency calculation shows that all Consistency Ratio (CR) values are below 0.1. Based on these calculations, the geometric mean alternative comparison

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matrix for all criteria is said to be consistent and can be used to obtain results in accordance with the aim of using the AHP method.

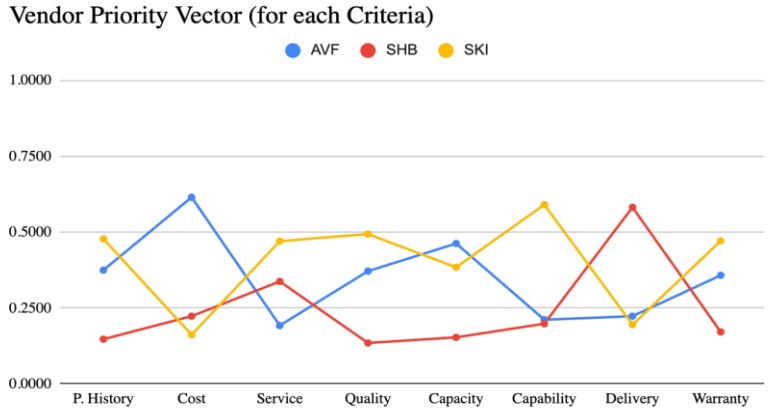

Figure 9: Alternative Priority Vector for Each Criteria

The chart above in Figure 9 was created to shows the priority vector level of the existing vendor alternatives for each criterion. It can be seen that the AVF vendor alternative is superior in cost and capacity criteria, SHB is superior in Delivery, and SKI is superior in Performance History, Service, Quality, Capability and Warranty criteria.

Table 10: Alternative Priority Vector

	AVF Vendor	SHB Vendor	SKI Vendor
Priority Vector	**2.8083**	**1.9476**	**3.2441**

The final result of the alternative priority score is found by calculating the total alternative priority vector in each existing criterion as shown in Table 10. By knowing the final priority score, the ranking of the alternative among the three existing alternatives can be determined.

4. ***Analytics Hierarchy Process Ranking Results:***
Based on calculations and consistency checks on the criteria and alternative matrix according to the Analytics Hierarchy Process method, ranking and priority results were found for both as shown in the figures below.

Table 11: AHP Ranking Results

Criteria Ranking								
Ranking	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Criteria	**Capability**	**Quality**	**Cost**	**Service**	**Capacity**	**Delivery**	**Warranty**	**Performance History**
Priority Vector	0.3668	0.1848	0.1382	0.1068	0.0654	0.0606	0.0525	0.0249
Alternative Ranking								
Ranking	**1**	**2**	**3**					
Criteria	**SKI**	**AVF**	**SHB**					
Priority Vector	3.2441	2.8083	2.8083					

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From Table 1.10, the author can find out that the first priority ranking for criteria is capability, followed sequentially by quality, cost, service, capacity, delivery, warranty, and performance history. Meanwhile, in calculating the priority of existing alternative, the author can see that the best ranked first alternative is the SKI vendor, followed by the AVF vendor, and finally the SHB vendor.

CONCLUSION

Saejiva launched its first two perfume variants in October 2023 but faced issues with its initial vendor, resulting in long delivery times, poor quality control, and potential revenue losses of 2.5 million rupiah, damaging its reputation. Despite these challenges, Saejiva kept the vendor for the initial batch. Acknowledging that vendor selection was the root of its problems, Saejiva plans to re-evaluate its process for future variants to ensure quality, timely delivery, and business continuity, stabilizing sales revenue.

Through initial secondary data collection and FGD expert interviews using the Jury of Executive Opinion approach and questionnaires for data analysis via the Analytic Hierarchy Process, the research effectively addressed the research questions and objectives outlined in the initial chapter. The study identified eight essential criteria influencing the selection of a fragrance manufacturing outsourcing company for Saejiva: performance history, cost, service, quality, capacity, capability, delivery, and warranty. Further analysis revealed that capability is the most important criterion (priority vector: 0.3668), followed by quality (0.1848), cost (0.1382), service (0.1068), capacity (0.0654), delivery (0.0606), warranty (0.0525), and performance history (0.0249). Based on AHP alternative weighting, SKI emerged as the best-suited manufacturing outsourcing company for Saejiva (priority vector: 3.2441), followed by AVF (2.8083), and SHB (1.9476). Therefore, Saejiva should choose SKI for producing the next perfume variant.

RECOMMENDATION

To ensure successful outsourced fragrance production, Saejiva is recommended to improve various aspects and develop strategies based on this research's vendor selection results.

1. Create Standard Operating Procedures to regulate the vendor selection that has been carried out by Saejiva and also for the future, is very necessary and needs to be designed by the management level of Saejiva. This makes all selection processes well-procedured and able to have an impact on a maximal and efficient Saejiva production system.
2. Sample production costs must be included in the monetary requirements because in evaluating the quality of products made by vendors, Saejiva must be able to obtain product samples first. Apart from that, including a BPOM license fee is also required as a prerequisite for obtaining a distribution permit to comply with existing regulations.
3. Regularly update and monitor vendor conditions to ensure their long-term viability and Saejiva's sustainability.
4. Continuously assess vendor performance, remain open to alternative vendors, and avoid over-reliance on a single vendor to stay competitive in the cosmetic industry.

The author acknowledges the scope and limitations of this research, which may lead to imperfections in execution and results. This leaves room for future research to improve upon and build from the data used in this study. Future studies could incorporate sub-criteria, gather primary data from experts in various disciplines, or use different multi-criteria decision-making methods. Additionally, the author recommends exploring new criteria for vendor selection that may emerge in different contexts and situations.

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