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Analysis of Criteria for Supplier Selection of Soybean Raw Materials Using the Analytical Hierarchy Process (AHP) Method at Sagala Tofu and Tempeh MSMEs

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Abstract
Sagala Tofu and Tempeh MSMEs face challenges in selecting soybean suppliers due to inconsistencies in price, quality, and delivery reliability, which impact production and market demand fulfillment. Sagala Tofu and Tempe MSME is one of the MSMEs that requires 100–150 kg of soybeans daily. This research aims to help Sagala Tofu and Tempe MSME identify the correct standards (priority criteria/sub-criteria) for making decisions regarding soybean raw materials and to determine the best soybean supplier. The research method used is the Analytical Hierarchy Process (AHP). The results show that the priority criterion is quality (0.469), followed by price (0.230), quantity accuracy (0.159), delivery (0.102), and customer care (0.038). Based on these supplier selection criteria, supplier X was rated the best, with a score of 0.420, followed by supplier Z (0.340) and supplier Y (0.240).
Keywords: Supplier Selection, Analytical Hierarchy Process, Criteria, Supplier

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INTRODUCTION

According to Tambunan (2013), MSMEs are independent business entities run by individuals or organizations in various economic sectors. They often face challenges that require wise strategies to improve and maintain their performance. One aspect that needs special attention in managing MSMEs is procuring raw materials. Procuring raw materials plays a vital role in ensuring smooth operations and the quality of the final product.

Supplier selection is a significant issue affecting MSMEs' performance and sustainability. For example, the timelessness, quality, and sustainability of raw material supply from suppliers can affect production and maintain market competitiveness. Supplier selection is a complex activity because it is vital in improving supply chain efficiency and ensuring optimal product quality standards. Therefore, an approach is needed to integrate both aspects into measurement (Wirdianto & Unbersa, 2008).

Sagala Tofu and Tempeh MSMEs, located in Kampung Baru, Sagulung, is a business engaged in the food production industry, with its main products being Tofu and Tempeh. The products these MSMEs produce use natural ingredients in their production process, with the primary raw material being soybeans. In its production process, Sagala Tofu and Tempeh MSMEs require 100-150 kg of soybeans daily. After approximately five years of operation, Sagala Tofu and Tempeh MSMEs still face challenges in managing their supply chain, one of which is the selection of suppliers of soybean raw materials. Sagala Tofu and Tempeh MSMEs have not implemented standards in the decision-making process related to purchasing soybeans.

Table 1. Raw Materials Suppliers

Suppliers	The Problem
Supplier X	Price is more expensive Better-quality soybeans are suitable for making tofu and tempe Delivery late up to 2 days
Supplier Y	The price is not too expensive Good quality soybeans are suitable for making tofu and tempe Delivery late up to 3 days
Supplier Z	Cheaper price Soybean quality is inconsistent, sometimes only suitable for tofu. Delivery late up to 3 days

Source: Sagala Tofu and Tempeh MSMEs

Table 1 shows three soybean suppliers at Sagala Tofu and Tempeh MSMEs, each with distinct challenges. First, Supplier X offers higher prices than the other suppliers but provides relatively better quality. However, their delivery is consistently delayed by 2 days. On the other hand, Supplier Y offers a more reasonable price, but the quality of their soybeans is mediocre, and their delivery time tends to be 3 days late. Lastly, Supplier Z presents the most affordable prices, yet their quality is inconsistent, and they also experience delivery delays of 3 days to reach the factory. These factors complicate the supplier selection process for Sagala Tofu and Tempeh MSMEs, as they must balance cost, quality, and reliability in their procurement strategy.

The problem often faced by Sagala Tofu and Tempeh MSMEs is the discrepancy between the number of soybeans received from suppliers and the number of orders submitted. In addition, there is the possibility of delays in the delivery of raw materials, and the quality of soybeans sometimes does not meet expectations. These challenges could hinder the smooth production process, causing obstacles to meeting market demand and ultimately impacting the performance and sustainability of Sagala Tofu and Tempeh MSMEs.

Therefore, selecting suppliers of Sagala Tofu and Tempeh MSMEs needs to be carried out by considering the value of the criteria that have been set and meet the standards of Sagala Tofu and Tempeh MSMEs. The analytical hierarchy process (AHP) analysis method is appropriate for overcoming obstacles.

AHP, or Analytical Hierarchy Process, effectively handles supplier selection problems involving several criteria. By implementing this approach, SMEs can determine and evaluate their suppliers to determine the proper supplier criteria and alternatives. This approach allows decision-makers to describe complex problems in the form of a hierarchy or a series of levels of integration.

RESEARCH METHOD

Operational Variables

Surjasa et al. (2006) provide several variables in selecting suppliers used as guidelines in this analysis, namely, as follows:

a. Price is a nominal value determined as compensation for a product or service. The price of soybean raw materials affects the profits obtained by Sagala Tofu and Tempeh MSMEs. The sub-criteria are the suitability of price about product quality (H1) and the ability to provide discounts on specific orders (H2)
b. Quality refers to the properties of a product that guarantees its high value. Sagala Tofu and Tempeh MSMEs prioritize the quality of soybean raw materials. Sub-criteria are Adhering goods to established specifications (Q1), Delivering goods without defect (Q2), and maintaining consistent quality (Q3).
c. Customer Care is the supplier's ability to respond to a problem or request. The sub-criteria are the speed of responding to customer inquiries (C1) and Responsiveness in resolving customer complaints (C2)
d. Delivery is the supplier's ability to deliver products within a specified time frame. The sub-criteria are the efficiency of providing items by the agreed date (D1) and the ability in transportation management (D2)
e. Accuracy of Quantity is the conformity of the quantity sent by the supplier with the amount requested by the customer.

Data Collection

The data collection procedures applied in this research include:

a. Observation is carried out by clearly observing previously planned objects over a certain period.
b. Interviews, an unstructured interview method, were applied, and the researcher interacted directly with the factory owner and head of production.
c. The questionnaire in this study refers to the format proposed by Saaty (1994), including criteria, sub-criteria, and choices in selecting suppliers for Sagala Tofu and Tempeh MSMEs. This study employs expert judgment by utilizing knowledgeable informants relevant to the required data. Based on these criteria, two informants were selected for data collection: the business owner and the head of the production department. Their expertise ensures the evaluation process aligns with the business's operational needs and strategic goals.

Data Analysis

The research method applied is the Analytical Hierarchy Process (AHP). The following are the stages in determining suppliers:

a. Creating a Hierarchical Structure.

The Analytical Hierarchy Process (AHP) method presents criteria in a hierarchical structure. This analysis determines criteria and sub-criteria as the basis for consideration used by MSMEs in the supplier selection process. The supplier selection problem in the Sagala Tofu and Tempe MSME is arranged in three hierarchical levels, as explained in Figure 1. Level 0 includes the main objectives, the first level provides supplier selection criteria, level 2 contains sub-criteria, and level 3 is the supplier options to be selected.

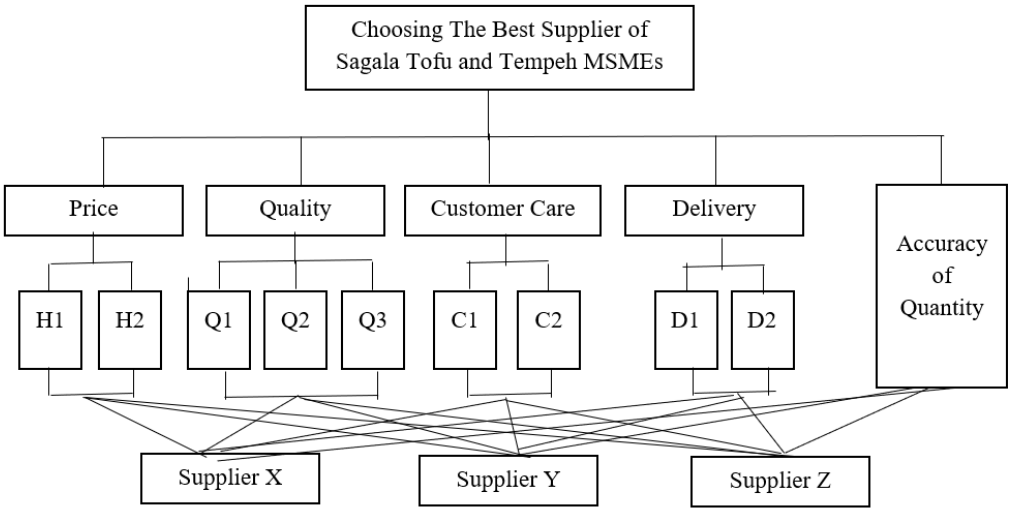

Figure 1 Hierarchical Structure

b. Construct a comparative matrix that reflects each element's proportional contribution to the criteria targets at the hierarchical level above it.
c. Find the unity value among the respondents' assessments using the geometric mean formula. The formula is:

$$\text{Geomean} = \sqrt[n]{a1 \times a2 \times a3 \ldots\ldots an}$$

Note:
a = Value of the pairwise comparison matrix for each criterion
n = Total number of respondents

d. Perform priority weight calculations for each criterion, sub-criteria, and alternative.
e. Calculate λ max using the formula:

$$\lambda \max = \frac{\sum v}{n}$$

f. Once λ max is known, the next step is to calculate the CI (Consistency Index) by:

$$CI = \frac{(\lambda \max - n)}{(n-1)}$$

Note:
CI = Consistency index
λ max = Maximum eigenvalue
n = Order of matrix

g. Next, calculate the AHP Consistency Ratio by:

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

Note:
CR = Consistency Ratio
RI = Random Index

RESULTS AND DISCUSSION

Pairwise Comparison Matrix

The assessment results from the two respondents regarding the criteria were then averaged using the geometric mean, as presented in Table 2 below.

Table 2. Pairwise Comparison Matrix of Criteria

Criteria	Price	Quality	Customer Care	Delivery	Accuracy of Quantity
Price	1,000	0.258	6,325	2,449	2,449
Quality	3,873	1,000	6,928	5,000	2,828
Customer Care	0.158	0.144	1,000	0.258	0.177
Delivery	0.408	0.200	3,873	1,000	0.577
Accuracy of Quantity	0.408	0.354	5,657	1,732	1,000

Source: Processed data, 2024

Table 2 presents a Pairwise Comparison Matrix for five criteria in supplier selection: Price, Quality, Customer Care, Delivery, and Accuracy of Quantity, using the Analytical Hierarchy Process (AHP). The matrix helps prioritize these criteria to guide decision-making in selecting the best supplier for Sagala Tofu and Tempeh MSMEs. Next, the results of the previous table are normalized by dividing the values in the rows of each criterion. The normalization results can be seen in Table 3 below.

Table 3. Normalization of Pairwise Comparison Criteria

Criteria	Price	Quality	Customer Care	Delivery	Accuracy of Quantity
Price	0.171	0.132	0.266	0.235	0.348
Quality	0.662	0.511	0.291	0.479	0.402
Customer Care	0.027	0.074	0.042	0.025	0.025
Delivery	0.070	0.102	0.163	0.096	0.082
Accuracy of Quantity	0.070	0.181	0.238	0.166	0.142

Source: Processed data, 2024

Table 3 presents the normalization of the pairwise comparison criteria, adjusting the raw values to a range between 0 and 1. This process helps to highlight the relative importance of each criterion. The normalized values are used to calculate the overall weighted scores for each criterion in the supplier selection process. The following is the pairwise comparison matrix after the geomean results of the sub-criteria are obtained.

Table 4. Pairwise Comparison Matrix of Sub-Criteria

Sub Criteria	H1	H2	
H1	1,000	6,481	
H2	0.154	1,000	
Sub Criteria	**Q1**	**Q2**	**Q3**
Q1	1,000	0.926	1,581
Q2	1,080	1,000	3,464
Q3	0.632	0.289	1,000
Sub Criteria	**C1**	**C2**	
C1	1,000	5,477	
C2	0.183	1,000	
Sub Criteria	**D1**	**D2**	
D1	1,000	6,481	
D2	0.154	1,000	

Source: Processed data, 2024

The normalization values of the sub-criteria can be seen in Table 5 below.

Table 5. Normalization of Pairwise Comparison of Sub-Criteria

Sub Criteria	**H1**	**H2**	
H1	0.866	0.866	
H2	0.134	0.134	
Sub Criteria	**Q1**	**Q2**	**Q3**
Q1	0.369	0.418	0.262
Q2	0.398	0.452	0.573
Q3	0.233	0.130	0.165
Sub Criteria	**C1**	**C2**	
C1	0.846	0.846	
C2	0.154	0.154	
Sub Criteria	**D1**	**D2**	
D1	0.866	0.866	
D2	0.134	0.134	

Source: Processed data, 2024

The following is the pairwise comparison matrix after the geomean results of the alternatives are obtained.

Table 6. Alternative Pairwise Comparison Matrix

Criteria	**Sub Criteria**	**Alternative**	**Supplier X**	**Supplier Y**	**Supplier Z**
Price	H1	Supplier X	1,000	3,873	1,000
		Supplier Y	0.258	1,000	0.236
		Supplier Z	1,000	4,243	1,000
	H2	Supplier X	1,000	1,414	4,243
		Supplier Y	0.707	1,000	2,828
		Supplier Z	0.236	0.354	1,000
Quality	Q1	Supplier X	1,000	1,581	3,873
		Supplier Y	0.632	1,000	1,581
		Supplier Z	0.258	0.632	1,000
	Q2	Supplier X	1,000	1,000	0.845
		Supplier Y	1,000	1,000	1,414
		Supplier Z	1,183	0.707	1,000
	Q3	Supplier X	1,000	7,483	1,732
		Supplier Y	0.134	1,000	0.250
		Supplier Z	0.577	4,000	1,000
Customer Care	C1	Supplier X	1,000	6,325	1,000
		Supplier Y	0.158	1,000	0.144
		Supplier Z	1,000	6,928	1,000
	C2	Supplier X	1,000	3,873	0.707
		Supplier Y	0.258	1,000	0.408
		Supplier Z	1,414	2,449	1,000
Delivery	D1	Supplier X	1,000	6,481	5,000
		Supplier Y	0.154	1,000	0.408
		Supplier Z	0.200	2,449	1,000
	D2	Supplier X	1,000	0.894	0.655
		Supplier Y	1,118	1,000	0.408
		Supplier Z	1,528	2,449	1,000

Criteria	Sub Criteria	Alternative	Supplier X	Supplier Y	Supplier Z
Accuracy of Quantity		Supplier X	1,000	0.866	0.756
		Supplier Y	1,155	1,000	0.408
		Supplier Z	1,323	2,449	1,000

Source: Processed data, 2024

The normalization values of the alternatives can be seen in Table 7 below.

Table 7. Normalization of Alternative Pairwise Comparison

Criteria	Sub Criteria	Alternative	Supplier X	Supplier Y	Supplier Z
Price	H1	Supplier X	0.443	0.425	0.447
		Supplier Y	0.114	0.110	0.105
		Supplier Z	0.443	0.465	0.447
	H2	Supplier X	0.515	0.511	0.526
		Supplier Y	0.364	0.361	0.350
		Supplier Z	0.121	0.128	0.124
Quality	Q1	Supplier X	0.529	0.492	0.600
		Supplier Y	0.335	0.311	0.245
		Supplier Z	0.137	0.197	0.155
	Q2	Supplier X	0.314	0.369	0.259
		Supplier Y	0.314	0.369	0.434
		Supplier Z	0.372	0.261	0.307
	Q3	Supplier X	0.584	0.599	0.581
		Supplier Y	0.078	0.080	0.084
		Supplier Z	0.337	0.320	0.335
Customer Care	C1	Supplier X	0.463	0.444	0.466
		Supplier Y	0.0733	0.070	0.067
		Supplier Z	0.463	0.486	0.466
	C2	Supplier X	0.374	0.529	0.334
		Supplier Y	0.097	0.136	0.193
		Supplier Z	1,414	2,449	1,000
Delivery	D1	Supplier X	1,000	6,481	5,000
		Supplier Y	0.154	1,000	0.408
		Supplier Z	0.200	2,449	1,000
	D2	Supplier X	1,000	0.894	0.655
		Supplier Y	1,118	1,000	0.408
		Supplier Z	1,528	2,449	1,000
Accuracy of Quantity		Supplier X	1,000	1,000	0.866
		Supplier Y	1,155	1,155	1,000
		Supplier Z	1,323	1,323	2,449

Source: Processed data, 2024

Determining Priority Weight

Determining priority weight is an essential stage in the decision-making process. Priority weight is obtained by dividing the total rows by the number of criteria.

Table 8. Criteria Priority Weight Results

Criteria	Total	Weight	Eigenvalue	Priority
Price	1,152	0.230	1,237	II
Quality	2,346	0.469	2,591	I

Criteria	Total	Weight	Eigenvalue	Priority
Customer Care	0.193	0.038	0.197	V
Delivery	0.513	0.102	0.531	IV
Accuracy of Quantity	0.797	0.159	0.814	III

Source: Processed data, 2024

Table 8 above shows that the priority criterion is quality (0,469). The second priority is price (0,230). The third priority is the accuracy of quantity (0,159). The fourth priority is delivery (0,102). And the last priority is customer care (0,038).

Table 9. Results of Sub-Criteria Priority Weights

Sub Criteria	Total	Weight	Eigenvalue	Priority
H1	1,732	0.866	1,732	I
H2	0.268	0.134	0.267	II
Q1	1,048	0.349	1,067	II
Q2	1,423	0.474	1,462	I
Q3	0.529	0.176	0.534	III
C1	1,691	0.846	1,691	I
C2	0.309	0.154	0.309	II
D1	1,732	0.856	1,733	I
D2	0.267	0.134	0.267	II

Source: Processed data, 2024

Table 9 presents the weights assigned to each sub-criterion. For the price criterion, sub-criterion H1 has the highest weight of 0.866, making it the top priority, while sub-criterion H2 ranks second with a weight of 0.134. In the quality criterion, sub-criterion Q2 is prioritized with a weight of 0.474, followed by Q1 at 0.349, and Q3, with a weight of 0.176, is ranked last. For the customer care criterion, sub-criterion C1 stands out as the primary focus with a weight of 0.846. Lastly, within the delivery criterion, sub-criterion D1 is prioritized with a weight of 0.856, while sub-criterion D2 occupies the last position with a weight of 0.134.

Table 10. Alternative Priority Weight Values

Criteria	Sub Criteria	Alternative	Total	Weight	Eigenvalue	Priority
Price	H1	Supplier X	1,315	0.438	1,315	II
		Supplier Y	0.329	0.110	0.329	III
		Supplier Z	1,355	0.452	1,356	I
	H2	Supplier X	1,551	0.517	1,552	I
		Supplier Y	1,076	0.359	1,076	II
		Supplier Z	0.373	0.124	0.373	III
Quality	Q1	Supplier X	1,621	0.540	1,640	I
		Supplier Y	0.891	0.297	0.896	II
		Supplier Z	0.488	0.163	0.490	III
	Q2	Supplier X	0.943	0.314	0.951	II
		Supplier Y	1,117	0.372	1,130	I
		Supplier Z	0.940	0.313	0.948	III
	Q3	Supplier X	1,765	0.588	1,765	I
		Supplier Y	0.242	0.081	0.242	III
		Supplier Z	0.993	0.331	0.993	II
Customer Care	C1	Supplier X	1,373	0.458	1,374	II
		Supplier Y	0.211	0.070	0.211	III
		Supplier Z	1,416	0.472	1,416	I

Criteria	Sub Criteria	Alternative	Total	Weight	Eigenvalue	Priority
Delivery	C2	Supplier X	1,237	0.412	1,278	II
		Supplier Y	0.426	0.142	0.430	III
		Supplier Z	1,336	0.445	1,377	I
	D1	Supplier X	2,171	0.724	2,242	I
		Supplier Y	0.278	0.093	0.279	III
		Supplier Z	0.550	0.183	0.555	II
	D2	Supplier X	0.797	0.266	0.805	II
		Supplier Y	0.735	0.245	0.742	III
		Supplier Z	1,468	0.489	1,495	I
Accuracy of Quantity		Supplier X	1,000	0.837	0.279	0.852
		Supplier Y	1,155	0.752	0.251	0.765
		Supplier Z	1,323	1,410	0.470	1,454

Source: Processed data, 2024

Table 10 shows the weights assigned to each supplier for the sub-criteria. In sub-criterion H1, supplier Z is identified as the top priority with a weight of 0.452. For sub-criterion H2, supplier X is determined as the primary focus with a weight of 0.517. Furthermore, in sub-criterion Q1, supplier X is again considered the main focus with a weight of 0.540. In sub-criterion Q2, the main focus is on supplier Y, which has a value of 0.588. Sub-criterion C1 shows supplier Z as the primary focus with a value of 0.472, and in sub-criterion C3, supplier Z is also the main focus with a value of 0.445. In sub-criterion D1, supplier Z is again the main focus, with a weight of 0.489. Finally, supplier Z is the top priority for the quantity accuracy criterion, with a weight of 0.470.

Selecting the Optimal Supplier

After the criteria and alternatives are obtained, the next step is to synthesize to determine the overall weight of each alternative based on the existing criteria. However, local weights must be calculated first to obtain their global value (global priority). This global value is obtained by multiplying the local priority by the priority of the higher criteria level.

Table 11. Global Priorities

Objective	Criteria	Sub Criteria	Weight	Alternative	Weight
Choosing the Best Supplier of Sagala Tofu and Tempeh MSMEs	Price (0.230)	H1	0.200	Supplier X	0.087
				Supplier Y	0.022
				Supplier Z	0.090
		H2	0.031	Supplier X	0.016
				Supplier Y	0.011
				Supplier Z	0.031
	Quality (0.469)	Q1	0.349	Supplier X	0.189
				Supplier Y	0.104
				Supplier Z	0.057
		Q2	0.164	Supplier X	0.052
				Supplier Y	0.061
				Supplier Z	0.051
		Q3	0.083	Supplier X	0.049
				Supplier Y	0.007
				Supplier Z	0.027
	Customer Care (0.038)	C1	0.033	Supplier X	0.015
				Supplier Y	0.002
				Supplier Z	0.015

Objective	Criteria	Sub Criteria	Weight	Alternative	Weight
				Supplier X	0.002
		C2	0.006	Supplier Y	0.001
				Supplier Z	0.003
				Supplier X	0.064
		D1	0.089	Supplier Y	0.008
	Shipping (0.102)			Supplier Z	0.016
				Supplier X	0.004
		D2	0.014	Supplier Y	0.003
				Supplier Z	0.007
				Supplier X	0.044
	Accuracy of Quantity (0.159)			Supplier Y	0.040
				Supplier Z	0.075

Source: Processed data, 2024

After the global priority is obtained, the overall value of each alternative is calculated by accumulating all the total weights (global priority) for every supplier. The findings are displayed in the table below.

Table 1 Overall Alternative Weights

Alternative	Weight	Priority
Supplier X	0.420	I
Supplier Y	0.240	III
Supplier Z	0.340	II

Source: Processed data, 2024

Table 12 indicates that supplier X is the primary choice for raw soybean materials for Sagala Tofu and Tempeh MSMEs, with a weight of 0.420. Supplier Z is the second option with a weight of 0.340, while supplier Y ranks last with 0.240.

Table 2 Alternative Weights Against Criteria

Criteria	Supplier X	Supplier Y	Supplier Z
Price	**0.448**	0.139	0.413
Quality	**0.417**	0.312	0.272
Customer Care	0.451	0.081	**0.468**
Delivery	**0.642**	0.119	0.238
Accuracy of Quantity	0.278	0.249	**0.473**

Source: Processed data, 2024

According to Table 13, supplier X excels in several criteria, namely the price criterion (0.448), the quality criterion (0.417), and the delivery criterion (0.642). Meanwhile, supplier Z leads in customer care (0.468) and quantity accuracy (0.473).

Testing Consistency

The next step is to calculate the maximum eigenvalue (λ max). The following is an example of calculating λ max for the criteria category.

$$\lambda \max = \frac{(0{,}28492942+1{,}2161419+0{,}0076074+0{,}1298275}{5}$$

$$= 5.2662383762$$

After obtaining the max λ value, the next step is calculating the CI value. An example of the calculation is as follows.

CI = (λ max – n)/(n-1)
= (5.2662383762 – 5) / (5-1)
= 0.262383762/4
= 0.065595941

The final step is to calculate the CR value, where the calculation is as follows.
CR = CI/RI
*RI = Random Index, where the criteria are of order five, then the RI value = 1.12.

CR = CI/RI
= 5.262383762/1.12
= 0.0058567804

If CR <0.1 = consistent, then the data above is consistent.
The following table of overall calculations of λ max, CI, and CR.

Table 3 Consistency Calculation Results

Paired Comparison	λ max	CI	CR	Information
Inter Criteria	5,262383	0.065595	0.058568	Consistent
Between Sub-Price Criteria	2	0	0	Consistent
Between Sub-Quality Criteria	3.055986	0.027993	0.048264	Consistent
Between Customer Care Sub-Criteria	2	0	0	Consistent
Between Sub-Shipping Criteria	2	0	0	Consistent
Between Alternatives Against Sub Criteria H1	3,000924	0.000462	0.000796	Consistent
Inter-Alternative Against Sub Criteria H2	3,000385	0.000193	0.000332	Consistent
Between Alternatives Against Sub Criteria Q1	3.021363	0.010682	0.018417	Consistent
Between Alternatives Against Sub Criteria Q2	3.029522	0.014761	0.025450	Consistent
Between Alternatives Against Sub Criteria Q3	3,00066	0.00033	0.000569	Consistent
Between Alternatives Against Sub Criteria C1	3,000924	0.000462	0.000796	Consistent
Inter-Alternative Against Sub Criteria C2	3.072677	0.036339	0.062653	Consistent
Inter Alternatives Against Sub Criteria D1	3.045638	0.022819	0.039343	Consistent
Inter Alternatives Against Sub Criteria D2	3.038044	0.019022	0.032796	Consistent
Between Alternatives Against the Criteria of Accuracy of Quantity	3.064632	0.032316	0.055717	Consistent

Source: Processed data, 2024

Table 14 shows that the overall CR value is <0.1, indicating that all evaluation data are consistent and do not need to be conducted again.

Discussion

According to the AHP analysis, quality is the dominant criterion for selecting suppliers at Sagala Tofu and Tempeh MSMEs, weighing 0,469. Price is the next most important criterion, at 0,230, followed by quantity accuracy at 0,159, delivery at 0,102, and customer care at 0,038. This focus on quality indicates that Sagala Tofu and Tempeh MSMEs value high-quality raw materials, which are crucial for improving final product quality.

The study evaluates three sub-criteria for quality, namely adherence to established specifications (Q1), delivery of goods without defect (Q2), and the ability to maintain consistent quality (Q3). The most important is the delivery of goods without defect (Q2), weighted at 0.474,

with supplier Y ranked highest (0.372) for consistently defect-free soybeans, unlike suppliers X and Z, which occasionally provide defective products. For adherence of goods to established specifications (Q1), supplier X leads with a weight of 0.540, followed by supplier Y (0.297) and supplier Z (0.163). In terms of the ability to maintain consistent quality (Q3), supplier X ranks first (0.588), followed by supplier Z (0.331) and supplier Y (0.081). Overall, supplier X is the top choice for quality (0.417), followed by supplier Y (0.312) and supplier Z (0.272).

The price criterion ranked second with a weight of 0.230, significantly impacting the final product's cost. It includes two sub-criteria, namely the suitability of price about product quality (H1), with a weight of 0.866, and the ability to provide discounts on specific orders (H2), with a weight of 0.134. For the suitability of price about product quality (H1), supplier Z ranks highest (0.452), followed by supplier X (0.438) and supplier Y (0.110). In the ability to provide discounts on specific orders (H2) sub-criterion, supplier X leads (0.517), followed by supplier Y (0.359) and supplier Z (0.124). Overall, supplier X is the top choice for price (0.448), with supplier Z close behind (0.413) and supplier Y trailing (0.139). Despite higher prices, supplier X offers quality that justifies the cost.

The accuracy of the quantity criterion ranks third with a weight of 0.159. In the accuracy of quantity criterion, supplier Z is superior with a weight of 0.470, followed by supplier X with a weight of 0.279, and supplier Y in last place with a weight of 0.251. If supplier selection is based on this criterion, supplier X is the primary choice.

The delivery criteria ranked fourth with a weight of 0.102 and have two sub-criteria: the efficiency of delivering items by the agreed date (D1) with a weight of 0.856 and the ability in transportation management (D2) at 0.134. For efficiency of delivering items by the agreed date (D1), supplier X leads (0.724), followed by supplier Z (0.183) and supplier Y (0.093). In the ability in transportation management (D2), supplier Z ranks highest (0.489), followed by supplier X (0.266) and supplier Y (0.266). Overall, supplier X is the best choice for delivery, with a total weight of 0.642, followed by supplier Z (0.238) and supplier Y (0.119). Supplier X is the top choice when delivery is prioritized.

The customer care criterion ranks last with a weight of 0.037, consisting of two sub-criteria: speed responding to customer inquiries (C1), weighted at 0.846, and Responsiveness in resolving customer complaints (C2) at 0.154. For speed responding to customer inquiries (C1), supplier Z leads (0.472), followed closely by supplier X (0.458), while supplier Y trails (0.070). In Responsiveness in resolving customer complaints (C2), supplier Z again ranks first (0.445), followed by supplier X (0.412) and supplier Y (0.142). Overall, supplier Z performs best in customer care (0.468), followed by supplier X (0.451), with supplier Y in last place (0.081). Supplier Z is the top choice for customer service.

Overall, supplier X is identified as the premier supplier with a weight of 0,420, with supplier Z next at 0,340 and supplier Y at 0,240. This suggests that supplier X is the most appropriate choice for a long-term partnership.

CONCLUSION

The most dominant criteria in soybean raw material suppliers for Sagala Tofu and Tempe MSME are indicated by quality criteria valued at 0.469 as the primary focus. Price criteria are placed as the second focus with 0.230, followed by accuracy of quantity with a value of 0.159 as the third focus. Delivery criteria are assessed as the fourth focus, with a value of 0.102, and customer care is estimated at 0.038. Among the sub-criteria category, price suitability concerning product quality (H1) has the highest weight of 0.866. The efficiency of delivering items by the agreed date (D1) is measured with a weight of 0,856, followed by the speed of responding to customer inquiries (C1) at 0,846. Delivery of goods without defect (Q2) is assigned a weight of 0,474, adherence of goods to established specifications (Q1) is rated at 0,349, and the ability to maintain consistent quality (Q3) weighs 0,176. Responsiveness in resolving customer complaints (C2) is assigned a weight of 0.154, whereas the ability to provide discounts on specific orders (H2) and the ability in transportation management (D2) share the same weight, namely 0.134.

According to the evaluation of options, supplier X weighed 0,420, followed by supplier Z, which weighed 0,340, and supplier Y, which weighed 0,240. Therefore, supplier X was chosen as the main alternative for supplying soybean raw materials for Sagala Tofu and Tempeh MSMEs.

Considering the analysis and conclusions above, the author suggests MSMEs should pay attention to the weight of the supplier selection criteria when meeting the needs of soybean raw materials because each criterion has a different weight. That way, MSMEs can combine these criteria to get suppliers that suit their needs. This impacts MSMEs by saving time and costs, and the quality received is good. That way, MSME operational activities are not disrupted. For further research, researchers can use other criteria and methods, such as TOPSIS and fuzzy AHP, according to the needs of MSMEs. For further research, alternative supplier selection methods could be explored to complement or compare with AHP. Methods such as the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) and Data Envelopment Analysis (DEA) could provide different perspectives on supplier evaluation by considering efficiency and ranking alternatives based on closeness to an ideal solution. Additionally, Fuzzy AHP could be used to handle uncertainties in decision-making by incorporating linguistic variables. Future studies could also integrate Multi-Objective Optimization based on Ratio Analysis (MOORA) or Artificial Intelligence (AI)-based decision support systems to enhance the accuracy and automation of supplier selection processes.

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