Analysis of 220 ml cup supplier selection with AHP method and rating scale: case study PT. sabina tirta utama

Karine N. Lumenta*, Wahyuda, Suwardi Gunawan

Department of Industrial Engineering, Faculty of Engineering, Mulawarman University, Samarinda

*Corresponding author: karinathania0107@gmail.com

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Abstract. *PT. Sabina Tirta Utama is a company that produces Bottled Drinking Water (AMDK) in 220 ml cup packaging. The company has problems related to 220 ml cup suppliers such as found in cup packaging with holes when the goods arrive, the quantity does not match the demand so the company needs suppliers who match the company's criteria and produce good quality packaging through supplier selection and assisted with the selection method. decision. The method used in supplier selection is AHP and rating scale. The AHP method is used to obtain global weight values which are then used to assist in ranking with the rating scale method. The purpose of this study was to determine the criteria and sub-criteria for a 220 ml cup and to identify priority suppliers. Supplier selection using 5 criteria and 11 sub-criteria. AHP weighting results on quality criteria is 0.197, price with a weight result of 0.296 delivery with a weight result of 0.401, communication system with a weight result of 0.035, and packaging capability of 0.07. The results of supplier ranking with a rating scale obtained the priority of the first supplier with a final assessment result of 3.551, namely supplier A with a high-performance category. Meanwhile, another alternative priority is supplier B with a final result of 2.641 in the performance category according to standards.*

Keywords: AHP, rating scale, supplier, criteria, sub-criteria

1. Introduction

Supply Chain Management is the activity of managing supply and demand, including the procurement of raw materials, production inputs, production and assembly activities or processes, production storage activities and inventory management, shipping, and handling processes up to distribution to delivery to the end consumer (Sukma et al., 2022). Supply Chain Management has benefits such as minimizing inventory, reducing costs, reducing lead times, and increasing revenue (Yusuf et al., 2022). The role of suppliers is pivotal for the smooth running of tasks and supply chain development (Purnomo, 2021). Supplier selection is an important activity in the procurement department to achieve a competitive advantage (Wijaya & Setiawati, 2021). In choosing good suppliers for the company so that the desired production results are achieved, criteria are needed in selecting suppliers, the term criteria is better known as Dickson's Vendor Selection Criteria, there are 23 criteria that form the basis for selecting suppliers (Huda et al., 2020).

Suppliers play a major role in ensuring the availability of goods needed by the company (Novadila & Ernawati, 2021). Supplier selection is a strategic activity and becomes one of the important factors in improving the performance of a company. Therefore, it is very important for companies to be able to assess and select suppliers carefully and precisely to achieve a competitive advantage in the market. Supplier selection includes the process of finding potential suppliers and determining the possibility that the selected supplier is the best supplier for the company (Cakra & Baihaqi, 2020). A strong partnership relationship between companies and suppliers can provide good benefits for the company because the company can get suppliers that are in accordance with expectations in order to achieve optimal product production process results (Muzaki et al., 2018). Great attention is paid to the quality of inputs, as it is a necessary condition for companies to produce high-quality products. Every company uses its procedures to evaluate and select suppliers (Muhammad et al., 2020).

If the supplier is less responsible and responsive to fulfilling requests, it will cause problems, including the occurrence of stockouts and the length of production lead time at the company. Therefore, companies that have many alternative suppliers must be selective in choosing suppliers

(Chopra & Meindl, 2013). PT. Sabina Tirta Utama is a factory that produces Bottled Drinking Water in 220 ml cups. The company deals directly with several suppliers in carrying out the production process, especially product packaging suppliers. Research on supplier selection was carried out on bottled drinking water packaging, especially 220 ml cup packaging because there were frequent problems between the supplier of 220 ml cup packaging and the company.

In the company's production activities PT. Sabina Tirta Utama has problems related to suppliers of 220 ml cup packaging, namely packaging that is found in rejected condition or packaging in the form of a dent, packaging pieces that do not match, shipping prices are relatively expensive, sometimes deliveries not following the existing lead time, the packaging leaks easily because there are holes in the cup packaging, and the quantity does not match the request. To increase competitiveness and consumer needs, PT. Sabina Tirta Utama must be able to choose a supplier that matches the criteria for a packaging supplier that produces packaging with good quality, appropriate delivery time, and prices that are not relatively expensive. The statement of constraints and supplier criteria was stated by the Management Representative and Head of Quality Control of PT. Sabina Tirta Utama.

Pairwise comparisons in the AHP method are carried out in stages from the subjective assessment of the respondents which are the strengths of this method. The AHP method allows decision-makers to organize complex problems into a hierarchical form or an integrated series of levels. The main equipment of the AHP method is to have a functional hierarchy with the main input being human perception. Therefore, PT. Sabina Tirta Utama can use the AHP method in making decisions related to supplier selection because the AHP method is able to translate perceptions regarding company constraints, supplier criteria and sub-criteria, and alternative suppliers into a problem hierarchy with an integrated level. By using the AHP method, it is expected that companies can make decisions regarding cup packaging with guaranteed quality by choosing suppliers that have the highest priority value so that in calculating supplier priority the Rating Scale method can be used to produce suitable alternative supplier choices (Purnomo, 2021).

The rating scale is an assessment technique, namely the evaluator assesses suppliers by using a scale to measure the work behavior factors of a supplier. The data used in this method is the data obtained in the form of numbers which are then interpreted in a qualitative sense. The rating scale is also a systematic and structured observation method for reporting evaluation results (Haliq et al., 2020). The Rating Scale is used to obtain the order or priority of each supplier. Rating scale with a scale rating scale 1-5, Rating Scale is one method that can be used to build a rating system. Rating Scale, namely the data obtained in the form of numbers or quantitative data interpreted in a qualitative sense (Sesa et al., 2021).

In several previous studies regarding supplier selection using the AHP method, researchers used the AHP method in selecting 220 ml cup suppliers with consideration of the advantages of this method as well. The AHP method is used to get the best supplier based on the weighting results carried out on pairwise comparisons and then data processing is carried out in stages according to the working process of the AHP method. In the current study using the AHP method to determine the weight of the criteria and sub-criteria, then these weights will be used in data processing using the rating scale method to obtain selected suppliers based on the global weight input of criteria and sub-criteria and supplier performance assessment. The purpose of this study was to determine the criteria and sub-criteria in selecting suppliers for 220 ml water cup packaging at PT. Sabina Tirta Utama with the AHP method and to find out priority suppliers in the selection of PT. Sabina Tirta Utama with the Rating Scale method.

2. Method

The research was conducted at the Bottled Drinking Water Factory (AMDK) PT. Sabina Tirta Utama whose address is Jl Mas Penghulu, Samarinda Seberang, Samarinda, East Kalimantan. The research stage includes the preparation stage which contains observation of research sites and literature studies by collecting references from journals or books regarding supplier selection and the AHP method and then setting research objectives and research benefits. Then, at the data collection stage, 2 types of data were carried out, namely primary data and secondary data. Research framework can be seen Figure 1.

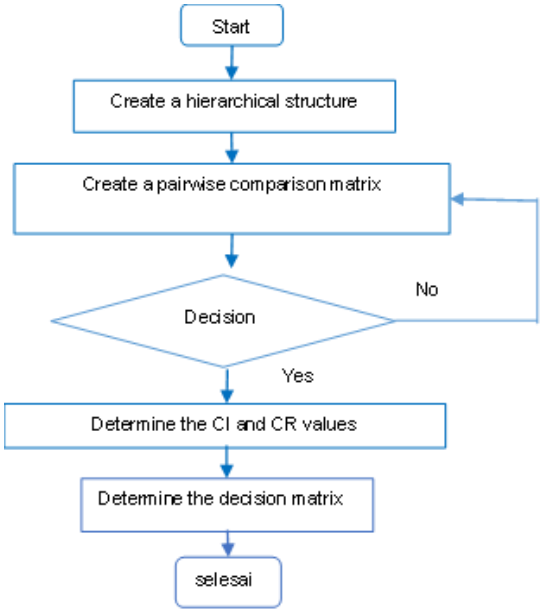

Figure 1 Research Framework

The Analytic Hierarchy Process was first discovered by Thomas L. Saaty, this method can assist in determining the priority of several criteria by conducting a pairwise comparison analysis of each predetermined criterion (Irawati, 2018). The Analytic Hierarchy Process is one of the decision support systems that is unique compared to the others. AHP is a decision-making technique or multivariate optimization used in comprehensive policy analysis by taking into account qualitative and quantitative matters (Hasiani et al., 2021). The Analytic Hierarchy Process is one of the decision support systems that is unique compared to the others. AHP is a decision-making technique or multivariate optimization used in comprehensive policy analysis by taking into account qualitative and quantitative matters (Kusuma et al., 2021).

During the observation activities were carried out to find out the production process and the form of packaging of goods used by suppliers. In the interview activities with vice management, it is necessary to obtain supplier data, supplier criteria, and constraint sub-criteria experienced related to the 220 ml cup supplier. In addition to adjusting to the wishes and conditions of the company, Dickson's Criteria is also a reference in determining the criteria for a 220 ml cup supplier. The selected criteria and sub-criteria were also subjected to a verification questionnaire to ascertain whether the company agreed with the selected sub-criteria. Then, fill out a pairwise comparison questionnaire to determine the relationship between criteria and sub-criteria for supplier selection by giving weight to each element. The rating scale or pairwise comparison weighting is shown in Table 1.

Table 1 Pairwise Comparison Scale

Interest Intensity	Explicative
1	Two criteria contribute equally to the objective
3	Judgement moderately favors one criterion over another
5	Judgement strongly favors one criterion over another
7	One criterion is favored very strongly over another
9	There is evidence favoring one criterion that is of the highest possible order of affirmation
2,4,6,8	When a compromise is required

Based on the collection of primary and secondary data that has been carried out to obtain data suitable for research, then data processing is carried out. In the data processing stage, supplier criteria are determined based on Dickson's criteria reference, then supplier selection uses a two-stage method, namely the Analytic Hierarchy Process (AHP) method, and the Rating Scale method. In the Analytic Hierarchy Process (AHP) method, the structure, and hierarchy of the existing problems are compiled and the weight of each supplier criterion is obtained, which is then

carried out in order of supplier priority using the Rating Scale method. So, after the two methods have been carried out, suppliers who meet the company's criteria are obtained. Analytic Hierarchy Process (AHP) method carried out in several stages as follows.

1. Define the problem and determine the desired solution, then arrange a hierarchy of the problems encountered. Hierarchical arrangement is to set goals which are the overall system objectives at the top level.
2. Determine the priority of elements
   a. The first step in determining the priority of elements is to make pairwise comparisons, namely comparing elements in pairs according to the given criteria.
   b. The pairwise comparison matrix is filled using numbers to represent the relative importance of an element to other elements.
3. Synthesis
   Considerations against pairwise comparisons are synthesized to derive overall priorities. The things to do in this step are as follows.
   a. Add up the values of each column in the matrix.
   b. Dividing each value from the column by the total of the column in question to obtain matrix normalization.
   c. Add up the values of each row and divide by the number of elements to get the average value.
4. Measure consistency
   In making decisions, it is important to know how good the consistency is because we do not want decisions based on judgments with low consistency. The things to do in this step are as follows.
   a. Multiply each value in the first column by the relative priority of the first element, the value in the second column by the relative priority of the second element, and so on.
   b. Total each row.
   c. The result of the sum of the rows is divided by the corresponding relative priority element.
   d. Add up the quotient above with the number of elements present, the result is called λ max
5. Measure Consistency Index (CI) with the following formula.
   $CI = (\lambda \text{ max} - n)/n - 1$ (1)
   Where,
   n = many elements
6. Measure Consistency Ratio (CR), with the following formula.
   $CR = CI/IR$ (2)
   Where,
   CR = consistency ratio
   CI = consistency index
   IR = index random consistency
6. Checking the consistency of the hierarchy, where there is a value of more than 10%, the assessor's data judgment must be corrected. However, if the consistency ratio (CI/IR) is less than or equal to 0.1 then the calculation results can be declared correct.

The Rating Scale is used to obtain the order or priority of each supplier. The Rating Scale method is carried out by appraisers of performance using a performance appraisal scale, the several stages of the Rating Scale method are as follows.

1. Appraisers provide an assessment of supplier performance using a predetermined performance rating scale. The performance rating scale can be seen in Table 2 as follows.

Table 2 Rating Scale

Rating Scale	Explicative
1	Unsatisfactory Performance
2	Improvement Desire
3	Meet Expectation
4	Exceed Expectation
5	Outstanding Performance

(Source: Sesa et al., 2021)

In assessing the performance of each supplier, a value scale is also needed to categorize supplier performance, the value scale can be seen in Table 3 (Profita et al., 2019).

Table 3 Rating Scale for Performance Category

Category	Description	Value intervals
Very good	Very high performance	4,21 - 5,00
Good	High performance	3,41 - 4,20
Acceptable	Standard performance	2,61 – 3,40
Poor	Low performance	1,81 – 2,60
Very poor	Very low performance	1,00 – 1,80

2. Then, a performance assessment is carried out by multiplying the criteria weight with the value obtained from the assessment questionnaire, using the following formula:

   Score= Weight x Value (3)

   dengan: Score = Assessment of performance criteria
   Weight = Numerical value of comparison between assessment criteria
   Scale = Rating scale
3. Perform supplier ranking by sorting the final performance value from the largest value to the smallest value.

3. Result and Discussion

The first method used in data processing is the AHP method, along with the results of data processing using the AHP method.

1) Based on the results of defining the problem, it was found that the company used 5 criteria and 11 sub criteria with 2 alternative suppliers in the supplier selection analysis. Then, a decision hierarchy is made consisting of 4 levels namely level 1 (goal level), level 2 (criteria level), level 3 (sub-criteria level), and level 4 (alternative level). The decision hierarchical structure can be seen in Figure 2 as follows.

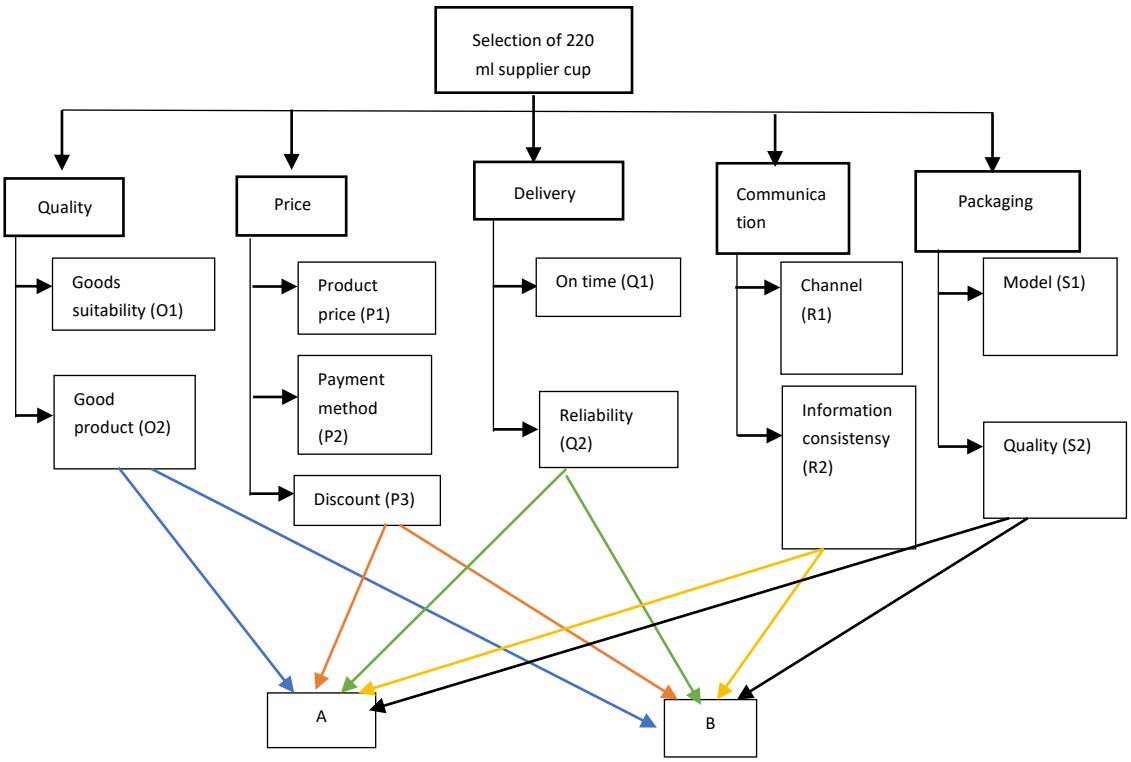

Figure 2 Hierarchy of 220 ml Cup Supplier Selection Decisions

In the next stage, a comparison matrix was carried out on the criteria and sub criteria, the results of the pairwise comparisons can be seen in Table 4, Table 5, Table 6, Table 7, Table 8, and Table 9.

Table 4 Criterion Pairwise Comparison Matrix

Criteria	(A)	(B)	(C)	(D)	(E)
Quality (A)	1	1	0,33	5	3
Price (B)	1	1	1	8	5
Delivery (C)	3	1,00	1	9	7
Communication system (D)	0,2	0,13	0,11	1	0,33
Packaging Abilities (E)	0,33	0,20	0,14	3	1

Table 5 Pairwise Comparison Matrix of Quality Sub Criteria

Criteria	(O1)	(O2)
Item alignment (O1)	1	7
Supply of goods without defects (O2)	0,14	1

Table 6 Pairwise Comparison Matrix of Price Sub Criteria

Criteria	(P1)	(P2)	(P3)
Product price (P1)	1	0,25	1
Payment method (P2)	4	1	7
Discount (P3)	1	0,14	1

Table 7 Pairwise Comparison Matrix of Delivery Sub Criteria

Criteria	(Q1)	(Q2)
On time (Q1)	1	1
Goods reliability (Q2)	1	1

Table 8 Pairwise Comparison Matrix of Communication System Sub Criteria

Criteria	(R1)	(R2)
Channel used (R1)	1	1
The level of consistency to the exchange information (R2)	1	1

Table 9 Pairwise Comparison Matrix of Packaging Abilities Sub Criteria

Criteria	(S1)	(S2)
Packaging creativities (S1)	1	0,33
Packaging qualities (S2)	3	1

2) Normalization and consistency test. Based on the results of the weighting of the criteria for each criterion comparison value divided by the number of appropriate columns, then look for the average value in each row so that the final criterion weight results are obtained. The calculation uses the following formula, and the result can be seen in Table 10.

$$Vij = Aij/Sij \quad (4)$$

Table 10 Results of Normalization and Priority

Criteria	(A)	(B)	(C)	(D)	(E)	Total	Vector Priority	Priority
Quality (A)	0,18	0,30	0,13	0,19	0,18	0,99	0,197	3
Price (B)	0,18	0,30	0,39	0,31	0,31	1,48	0,296	2
Delivery (C)	0,54	0,30	0,39	0,35	0,43	2,00	0,401	1
Communication system (D)	0,04	0,04	0,04	0,04	0,02	0,18	0,035	5
Packaging abilites (E)	0,06	0,06	0,06	0,12	0,06	0,35	0,070	4
Total	1,00	1,00	1,00	1,00	1,00	5,00		

Then, the maximum eigenvalue is calculated to carry out a consistency test using the following formulas.

a. The following is the formula for calculating the weight vector which is the product of the matrices

$a_{ij} = (A)(w^T) = (v)\ (w^T)$ (5)

b. The following is the formula for calculating eigen value

$\lambda =$ (Element in the i-th (A)(wT)) (6)

The consistency test uses the formula equations (1) and (2), the results of the criteria consistency test can be seen in Table 11 as follows.

Table 11 Criterion Consistency Test Results

Multiplication matrix	Division	Lambda	CI	RI	CR
1,06	7,57	5,43	0,11	1,12	0,096
1,55	3,85				
2,03	5,90				
0,18	5,47				
0,35	4,35				

The criteria are said to be consistent and accountable and the contents of the questionnaire can be justified if the CR value is ≤ 0.1, at the level 1 hierarchy, namely the criteria hierarchy has a CR value of 0.096 or ≤ 0.1. Thus, the hierarchy has consistent values. Normalization calculations and consistency tests are also carried out using the same formula at the level 3 hierarchy, namely the sub-criteria hierarchy so that consistency tests are produced on the sub-criteria hierarchies with consistent values, as can be seen in Table 12.

Table 12 Sub-criteria Consistency Test Results

Sub-criteria	Consistency ratio	Standard of consistency ratio	Explanation
Quality	0	0,1	Consistent
Price	0,03	0,1	Consistent
Delivery	0	0,1	Consistent
Communication system	0	0,1	Consistent
Packaging abilities	0	0,1	Consistent

In the next stage after the consistency test is carried out, then calculate the global weight using the following formula.

Global weight = the final weight of the criteria vector priority × the final weight of the sub-criteria vector priority (7)

The results of the global weight calculation performed on the sub criteria can be seen in Table 13.

Table 13 The Overall Global Weight Value of the Sub Criteria

Criteria	Sub-criteria	Weight
Quality	Item alignment (O1)	0,173
	Supply of goods without defects (O2)	0,025
Price	Product price (P1)	0,045
	Payment method (P2)	0,214
	Discount (P3)	0,038
Delivery	On time (Q1)	0,200
	Goods reliability (Q2)	0,200
Communication system	Channel used (R1)	0,018
	The level of consistency to the exchange information (R2)	0,018
Packaging abilities	Packaging creativities (S1)	0,018
	Packaging qualities (S2)	0,053

In the Rating Scale method, the data obtained is based on the results of the supplier performance assessment questionnaire. Supplier performance assessment is carried out on 2 alternative suppliers, the average value of a 220 ml cup supplier performance with a Rating Scale can be seen in Table 14.

Table 14 The Average Value of the Performance of a 220 ml Cup Supplier with a Rating Scale

No	Sub-criteria	Weight	Supplier's average value	
			A	B
1	Item alignment (O1)	0,173	3	4
2	Supply of goods without defects (O2)	0,025	4	2
3	Product price (P1)	0,045	5	3
4	Payment method (P2)	0,214	3	2
5	Discount (P3)	0,038	3	1
6	On time (Q1)	0,200	5	2
7	Goods reliability (Q2)	0,200	3	3
8	Channel used (R1)	0,018	4	2
9	The level of consistency to the exchange information (R2)	0,018	4	3
10	Packaging creativities (S1)	0,018	3	3
11	Packaging qualities (S2)	0,053	3	3

Based on the weight and average performance value of each supplier, then calculate the final supplier performance score by multiplying each sub-criteria weight with each supplier's performance value. The results of the final performance value of the 220 ml cup supplier can be seen in Table 15 as follows.

Table 15 The Final Value of the Performance of the 220 ml Cup Supplier with the Rating Scale

No	Sub-criteria	Weight	Supplier's average value	
			A	B
1	Item alignment (O1)	0,173	0,518	0,690
2	Supply of goods without defects (O2)	0,025	0,099	0,049
3	Product price (P1)	0,045	0,226	0,136
4	Payment method (P2)	0,214	0,641	0,427
5	Discount (P3)	0,038	0,113	0,038
6	On time (Q1)	0,200	1,002	0,401
7	Goods reliability (Q2)	0,200	0,601	0,601
8	Channel used (R1)	0,018	0,070	0,035
9	The level of consistency to the exchange information (R2)	0,018	0,070	0,053
10	Packaging creativities (S1)	0,018	0,053	0,053
11	Packaging qualities (S2)	0,053	0,158	0,158
	Total		3,551	2,641

Analysis of Criteria Weighting Results

In the previous study, it was carried out with the object of research, namely the packaging of bottled drinking water boxes, where the study used 6 criteria including: quality, delivery, price, production abilty, service and supplier characteristic. Priority criteria lies in the quality criteria with a weight of 0,33486, and there are 3 alternative suppliers. The priority of the selected supplier is supplier B with a weight of 6,15732. Supplier A has a weight of 4,50629 and Supplier C has a weight of 4,33640.

In data processing using the AHP method, the final weight of a criterion or sub-criteria shows the priority order of the criteria that influence the selection of 220 ml cup suppliers. The higher the weight, the greater the influence of these criteria in supplier selection. Vice versa, the smaller the criterion weight, the smaller the influence of these criteria in supplier selection. The highest final weight or the priority of the criteria is found in the shipping criteria with a weight of 0.401. The lowest final weight is found in the communication system criteria with a weight of 0.035. The result of the consistency ratio criterion is 0.096 or ≤ 0.1, which means that the weighting of pairwise comparisons on the questionnaire has a consistent value or weight. The explanation of the results of the analysis of each criterion is as follows.

1) Quality criteria
   The quality criteria have a final weight or vector priority weight of 0.197 and are ranked as the third priority criteria which indicates that quality criteria are important and quite influential criteria in the selection of 220 ml cup suppliers. The better the quality of the cup, the better the image of the company in producing a product and getting a sense of loyalty from consumers.
2) Price criteria
   The price criteria has a final weight or weight of the priority vector of 0.296 and ranks as the priority of the second criterion. This shows that the price criterion is important and influential in supplier selection, whereby having a price criterion the company can determine market prices following the intended target market.
3) Delivery criteria
   The delivery criteria have a final weight or priority vector weight of 0.401 and rank first. The order of priority shows that the delivery criteria are very important and have a major influence on supplier selection. With delivery criteria, companies can run an optimal production process and can minimize delays in meeting consumer needs due to the timeliness of suppliers in sending goods.
4) Communication system criteria
   In the communication system criteria, it has a final weight or priority vector weight of 0.035 and ranks fifth or last priority. The priority sequence shows that the communication system criteria are not very important and have no influence on supplier selection.
5) Packaging abilities criteria
   The packaging capability criteria has a final weight or vector priority weight of 0.07 and ranks fourth priority. This shows that the criteria for packaging ability are considered quite important and quite influential in supplier selection because by considering quality criteria, the selected supplier can provide safe packaging of goods to maintain the quality of goods during delivery, as well as packaging creativity which is an added value to the company's products later.

Analysis of Supplier Performance Assessment Results

Based on the results of supplier performance assessment data processing using the Rating Scale method, the final total value of supplier performance is obtained which is useful for obtaining alternative supplier sequences. The rating scale used in evaluating supplier performance can be seen in Table 2 and the category of supplier, performance can be seen in Table 3. The total results of the supplier performance assessment can be seen in Table 16.

Table 16 The Results of the 220 ml Cup Supplier Performance Assessment

No.	Supplier's Name	Final Results Performance Assesment	Rating Scale	Category
1.	Supplier A	3,551	Good	High performance
2.	Supplier B	2,641	Acceptable	Standard performance

Based on Table 16, supplier A has a higher performance value than supplier B, namely supplier A has a final performance rating of 3.551 in the high-performance category. Meanwhile, supplier B has a performance appraisal final result of 2.641 with a performance category according to standards.

Supplier A is the priority supplier in the 220 ml cup alternative supplier with a high-performance category, so supplier A can be an alternative supplier for the 220 ml cup. Supplier A's performance assessment has the highest score on the timely sub-criteria (Q1) with a performance value of 1.002. Meanwhile, supplier A's performance rating is the lowest on the packaging creativity sub-criteria (S1) at 0.053.

Supplier B is the second supplier in the alternative 220 ml cup supplier with a standard performance category. Supplier B's performance assessment has the highest score on the suitability of goods sub-criteria (O1) of 0.690, while the lowest score on the channel used sub-criteria (R1) is 0.035. The results of the analysis on each sub-criteria related to the average supplier value are described as follows.

1. In the sub-criteria for item alignment (O1) that supplier B has an average supplier performance value that is higher than supplier A. Meanwhile, the sub-criteria for the supply of goods without defects (O2) supplier A has an average performance value higher than supplier B.
2. In the product price sub-criteria (P1), supplier A has a higher average supplier performance value than supplier B, as well as the method of payment sub-criteria (P2) and discounts (P3).
3. In the timely sub-criteria (Q1), supplier A has a higher average supplier value than supplier B. Meanwhile, in the goods reliability sub-criterion (Q2), the supplier has the same average performance value for both suppliers.
4. In the channel sub-criteria used (R1) that supplier A has a higher average supplier performance value than supplier B, as well as the sub-criteria level of consistency with the exchange of information (R2).
5. The sub-criteria for packaging creativity (S1) and packaging quality (S2) have the same average supplier performance for each supplier.

4. Conclusion and Recommendation

The results of data collection and data processing show that supplier A occupies the top priority in the selection of 220 ml cup suppliers because it has a final average supplier performance value that is higher than supplier B. Supplier A has a final average supplier performance value of 3.551 with the category high performance. The results of this study can be used as a reference or reference for PT. Sabina Tirta Utama in choosing suppliers, especially 220 ml cup suppliers. In future research, other decision-making methods can be used in selecting 220 ml cup suppliers such as the ANP (Analytic Network Process) method, and FAHP (Fuzzy Analytic Hierarchy Process).

Reference

Cakra, B. H. A., & Baihaqi, I. (2020). Pemilihan Supplier Berbasis Lingkungan: Studi Kasus pada PT. Warisan Eurindo. *Jurnal Teknik ITS*, *9*(1). https://doi.org/10.12962/j23373539.v9i1.50428

Chopra, S., & Meindl, P. (2013). *Supply Chain Management: Strategy, Planning, and Operation*. Pearson.

Dias Irawati Sukma, Setiawan, I., Kurnia, H., Atikno, W., & Purba, H. H. (2022). Quality Function Deployment in Healthcare: Systematic Literature Review. *Jurnal Sistem Teknik Industri*, *24*(1), 15–27. https://doi.org/10.32734/jsti.v24i1.7297

Haliq, R., Sulistyowati, R. A., & Millah, N. (2020). Analisis Kepuasan Dan Kebutuhan Pengguna Lulusan Institut Teknologi Kalimantan Dengan Menggunakan Metode Rating Scale. *Jurnal Vokasi Indonesia*, *8*(2), 103–111. https://doi.org/10.7454/jvi.v8i2.198

Hasiani, F. M. U., Haryanti, T., Rinawati, R., & Kurniawati, L. (2021). Sistem Pendukung Keputusan Pemilihan Supplier Produk Ritel dengan Metode Analytical Hierarchy Process. *Sistemasi*, *10*(1), 139. https://doi.org/10.32520/stmsi.v10i1.1125

Huda, S., Pusporini, P., & Dahda, S. S. (2020). Pengaplikasian Metode Fuzzy Analytic Hierarchy Process (FAHP) Pada Penentuan Pemilihan Supplier Benang (Studi Kasus di CV. Sarung Indah Sejahterah). *JUSTI (Jurnal Sistem Dan Teknik Industri)*, *1*(1), 11. https://doi.org/10.30587/justicb.v1i1.2027

Irawati, N. (2018). Penerapan Metode Ahp Penerimaan Bantuan Desa Untuk Anak Berprestasi. *Seminar Nasional Royal (SENAR)*, *1*(1), 281–284.

Kusuma, A. A. A., Sulistyo, B., & Tripiawan, W. (2021). Analisis Penilaian Kinerja Karyawan Kontrak Pada Pt Wonojati Wijoyo Menggunakan Metode Rating Scale Dan Analytical Hierarchy Process (Ahp) Analysis of Performance Assessment of Contract Employees At Pt Wonojati Wijoyo Using Scale Rating Method and Analy. *EProceedings of Engineering*, *8 (3)*.

Muhammad, J., Rahmanasari, D., Vicky, J., Maulidiyah, W. A., Sutopo, W., & Yuniaristanto, Y. (2020). Pemilihan Supplier Biji Plastik dengan Metode Analitycal Hierarchy Process (AHP) dan Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). *Jurnal INTECH Teknik Industri Universitas Serang Raya*, *6*(2), 99–106. https://doi.org/10.30656/intech.v6i2.2418

Muhammad Yusuf, A., Soediantono, D., & Staf Dan Komando Angkatan Laut, S. (2022). Supply Chain Management and Recommendations for Implementation in the Defense Industry: A Literature Review. *International Journal of Social and Management Studies (Ijosmas)*, *3*(3), 63–77.

Muzaki, R., Utomo, D. S., & Rahayu K, D. K. (2018). Pemilihan Supplier Frozen Food Menggunakan Metode Analytic Network Process. *Prosiding Seminar Nasional Teknologi, Inovasi Dan Aplikasi Di Lingkungan Tropis*, *1*(1), 116–123.

Novadila, R., & Ernawati, D. (2021). Analisis Pemilihan Supplier Bahan Baku Gandum dengan Metode Fuzzy Analitycal Hierarchy Process (FAHP) di PT. Balihai Brewery Indonesia. *Juminten*, *2*(6), 72–83. https://doi.org/10.33005/juminten.v2i6.347

Profita, A., Priyambada, A., & Umar, M. (2019). Evaluasi Kinerja Supplier Air Minum Dalam Kemasan Dengan Metode Analytical Network Process Dan Rating Scale (Studi Kasus: Ritel X Kota Bontang, Kalimantan Timur). *Prosiding Seminar Nasional Teknologi V*, 109–116.

Purnomo, I. (2021). Penerapan Metode Analytical Hierarchy Process (Ahp) Dalam Pemilihan Supplier Terhadap Bahan. *Scientifict Journal of Industrial Engineering*, *2*(11161283), 1–5.

Sesa, L. A., Sitania, F. D., & Widada, D. (2021). Analisis Pemilihan Supplier Bahan Baku Roti dengan Metode ANP (Analytic Network Process) dan Rating Scale (Studi Kasus: Roti Gembong Kota Raja di Balikpapan). *Jurnal Optimalisasi*, *7*(1), 35. https://doi.org/10.35308/jopt.v7i1.3173

Wijaya, R. A., & Setiawati, N. M. (2021). Implementasi Supply Chain Management pada PT Central Proteina Prima Tbk. *Prosiding Seminar Nasional Ekonomi Dan Bisnis*, *1*(2020), 153–165. https://doi.org/10.33479/sneb.v1i.89