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Enrichment: Journal of Multidisciplinary Research and Development

Comparative Analysis of Factory Parts Supplier Performance Using the Vendor Performance Rating and Analytic Hierarchy Process Methods (Case Study of PT Pupuk Iskandar Muda)

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ABSTRACT

The availability of spare parts is the main factor that must be considered in the maintenance process so that maintenance can be carried out as planned. The availability of spare parts really depends on the procurement process which involves many parties including suppliers who are an important part of supply chain management in a company. Supplier assessment or evaluation in several previous studies was studied using several methods, including the Vendor Performance Rating ("VPR") method which is part of the SAP application and also the Analytic Hierarchy Process ("AHP") method. The aim of this research is to determine the weight of performance priorities in determining suppliers for factory spare parts procurement using the VPR and AHP methods. The objects of this research are factory spare parts suppliers registered with PT Pupuk Iskandar Muda, namely CV A, CV B, CV C, CV D and CV E. Based on the results of the analysis using the VPR method, it is CV A got the highest average score of 89.05 (weight percentage 23%), and the lowest was CV C with an average value of 78.17 (weight percentage 16%). The results using the AHP method are the highest as well as CV A 30% with a weight value of 0.3047, and the lowest is also CV C 9% with a weight value of 0.0822. Judging from these two methods, suppliers who perform well and poorly are the same.

Keywords: *Suppliers; Factory spare parts; performance weight; Analytical Hierarchy Process; Vendor Performance Rating*

INTRODUCTION

The availability of spare parts is the main factor that must be considered in the maintenance process so that maintenance can be carried out as planned. The availability of spare parts is highly dependent on the procurement process, which involves many parties, namely internal and external stakeholders (Bhattacharyya et al. 2023; Kallio 2024; Pakarinen 2021). The internal parties of the company are all departments involved in the procurement process, while the external parties are the suppliers who provide the parts (Chalari 2021; Melander 2018; Villena 2019).

The management of the procurement of goods and services is a series of activities aimed at fulfilling needs through the purchase of goods or the execution of service work. According to Siahaya (2013), procurement management is part of supply chain management, which systematically and strategically manages the procurement of goods and services, starting from the source of goods to their destination, based on the right time, quality, source, place, quantity, and price, in order to meet customer needs.

PT Pupuk Iskandar Muda (PT PIM) is a national company engaged in the fertilizer industry. The products produced include urea, NPK, Polivit, and ammonia fertilizers. In implementing its production processes, PT PIM has highly adequate production facilities and infrastructure, as well as international-standard technology (Amir et al. 2021; Polak-Kraśna et al. 2017; Rahim 2017). The presence of PT PIM in Aceh Province plays a key role in fulfilling fertilizer needs for agriculture and plantations in the northern part of Sumatra (Aceh Province,

North Sumatra, West Sumatra, Riau, and the Riau Islands).

PT PIM, as a state-owned enterprise (BUMN), operates in accordance with regulations issued by the Ministry of State-Owned Enterprises and other government regulations. In this context, the Department of Procurement of Goods and Services is required to carry out procurement activities efficiently, effectively, transparently, openly, competitively, fairly, and accountably, so as not to lose business momentum that could impact overall operations. The unavailability of spare parts resulting from procurement issues can affect planned factory maintenance activities, leading to high downtime and unmet production targets (Antosz et al. 2019; Skoumpopoulou et al. 2025; Zhu et al. 2022).

The presence of suppliers is a critical component of the supply chain management cycle at PT Pupuk Iskandar Muda because all materials—whether production machinery parts, auxiliary production materials, or chemicals—are supplied by selected vendors after the procurement process is conducted by the Department of Procurement of Goods and Services (Gopalakrishnan et al. 2015; Klünder et al. 2019; Organization 2020).

Based on this, it is essential to evaluate the performance of spare parts suppliers so that, in the supplier selection process—especially for spare parts—suppliers with strong performance can be chosen (Achetoui et al. 2019; Ghadimi et al. 2017; Meena et al. 2023). This is particularly important for emergency or urgent procurement requests, as well as for critical items that could halt factory operations if spare parts are unavailable during maintenance or repair activities (Handfield et al. 2020; De Martini 2021).

The Department of Procurement of Goods and Services at PT Pupuk Iskandar Muda evaluates supplier performance using the SAP system with transaction code (T-code) VPR in the MM (Materials Management) module. SAP (Systems, Applications, and Products in Data Processing) is the primary system used at PT PIM in its supply chain processes. Supplier performance evaluation reports are issued every three months and serve as the basis for assessing the performance of all suppliers involved in the procurement of goods and services at PT PIM.

In practice, however, the implementation of this system is still not optimal, and several weaknesses remain. For instance, in obtaining scores for assessment criteria, suppliers may still exploit loopholes in the system, resulting in maximum scores being awarded inaccurately. For example, in the evaluation of RFQ (Request for Quotation), a supplier may input a nominal value (e.g., Rp 1) and submit a letter or email declining to provide a price quotation; nevertheless, the system may automatically interpret this as a valid offer and assign the maximum score of 100 points. Similarly, in the evaluation of delivery time and quality criteria, suppliers and receiving personnel may still manipulate inputs to achieve maximum scores.

In fact, many alternative methods for assessing or evaluating suppliers have been used in various studies. One widely applied approach is the Analytic Hierarchy Process (AHP), which is a fundamental and general theory of measurement. The AHP method has the capability to address multi-objective and multi-criteria problems based on pairwise comparisons of preferences among elements within a hierarchy. Through hierarchical structuring, complex and unstructured problems can be decomposed into manageable groups, which are then organized into a hierarchical framework (Sri et al., 2011).

Several previous studies have applied the AHP method in evaluating supplier performance. Himawan (2022) stated that his research provided a method for PT X to

determine priorities in purchasing raw materials from suppliers; this method can also be reused when reassessing supplier priorities. Meanwhile, Naufal et al. (2021) concluded that supplier recommendations generated using the AHP method were based on the comparative values of priority criteria calculations, enabling accurate final recommendations for supplier selection.

From these studies, it can be inferred that the AHP method is capable of addressing interdependencies among elements within a system when assessing relative weights. AHP does not rely solely on linear thinking in decision-making and provides a structured scale for measuring multiple criteria, thereby facilitating priority determination. In its application, AHP integrates both tangible and intangible factors into a systematic framework and produces structured and simplified solutions for decision-making (Al-Harbi, 1999).

Based on the above, the purpose of this study—Comparative Analysis of Factory Parts Supplier Performance Using the Vendor Performance Rating and Analytic Hierarchy Process Methods (Case Study of PT Pupuk Iskandar Muda)—is to determine the priority weights of supplier performance criteria and to compare the effectiveness of the Vendor Performance Rating (VPR) and Analytic Hierarchy Process (AHP) methods in evaluating factory spare parts suppliers at PT Pupuk Iskandar Muda. This research is expected to contribute to PT Pupuk Iskandar Muda in identifying suppliers with superior performance based on weighted criteria.

METHOD

In this study, a descriptive method was used to provide an overview of the actual conditions based on existing data, facts, and events. The collected data were processed and analyzed using relevant analytical approaches, and the results served as the basis for discussion and conclusion. Predetermined formulas were applied to analyze the data. For testing purposes, a series of steps was carried out, starting from the operationalization of variables to data collection techniques.

The steps (block diagram) of the research design are shown in the following figure:

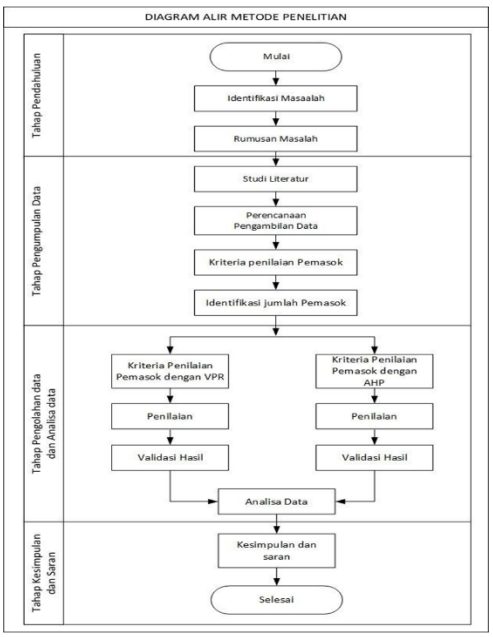

Figure 1. Research Flowchart
Source: Developed for this research, 2025

Data collection was a stage carried out to obtain the data needed for problem analysis. The data collection methods were conducted through the following stages:

A literature review was conducted to identify relevant theories and previous studies related to the research topic.

The suppliers to be assessed were determined, namely CV A, CV B, CV C, CV D, and CV E, all of which were local suppliers operating within the company's environment.

Research questionnaires were distributed and completed by personnel involved in the spare parts procurement process, including buyers in the Department of Procurement of Goods and Services, the warehousing section, and the quality control (QC) section.

Primary data were processed.

Secondary data were collected.

Data processing and analysis were carried out using the Analytic Hierarchy Process (AHP) and Vendor Performance Rating (VPR) methods.

Research recommendations were formulated based on the results obtained.

The data used in this study consisted of both qualitative and quantitative data. Qualitative data included supplier performance data from the Department of Procurement of Goods and Services over a six-month period (January to June 2023). Quantitative data consisted of survey results obtained from questionnaires completed by personnel directly involved in procurement activities and related work units.

Data processing was conducted after all required data had been collected. Supplier performance evaluation using the VPR method was carried out based on the SAP system applied at PT PIM, using data from the six-month period of January to June 2023. The error value was calculated using the Mean Absolute Percentage Error (MAPE) method.

Furthermore, data processing using the AHP method was conducted through the following steps:

1) Defining the problem and research objectives, along with identifying the relevant alternatives.
2) Structuring the problem into a hierarchical model to simplify analysis.
3) Determining the priority of each criterion through pairwise comparisons.
4) Conducting consistency testing to ensure the reliability of the comparisons and resulting priorities.

Based on the results obtained from data processing, the next stage involved analyzing and comparing the outcomes of the two methods. This analysis aimed to determine the priority weights of supplier performance criteria and evaluate supplier performance. The results of this analysis were then used to support decision-making and formulate final research conclusions.

RESULTS AND DISCUSSION

Performance weighting results based on the Vendor Performance Rating method

The Vendor Performance Rating (VPR) applied by the company in its assessment sets its own performance targets for suppliers related to the criteria of Other, RFQ, Delivery Time, Price and Quality. The five criteria above are assessed in the application so that the purpose of using the VPR application is achieved. The use of the VPR method in supplier ranking is useful for comparing alternative suppliers based on specific stages and criteria.

The following are the results of the supplier performance assessment using the VPR method using the SAP application.

Table 1. Results of Supplier Assessment with the VPR Method

Vendor	Vendor Name	Created On	Delivery Score	Quality Score	Price Score	RFQ Score	Others Score	Total Score	Average Score	% Weight
1000007273	CV A	24/07/2023	100,00	100,00	97,30	47,93	100,00	445,23	**89,05**	**23%**
1000012763	CV B	24/07/2023	80,00	85,86	85,00	58,62	100,00	409,48	**81,90**	**21%**
1000007269	CV E	24/07/2023	9,76	100,00	98,78	58,88	100,00	367,42	**73,48**	**19%**
1000007366	CV D	24/07/2023	71,43	100,00	74,29	18,59	100,00	364,31	**72,86**	**19%**
1000009976	CV C	24/07/2023	41,20	96,19	83,20	51,50	68,75	340,84	**68,17**	**18%**

Source: Secondary data of PT Pupuk Iskandar Muda (SAP MM Module), January-June 2023 period

From the table. 1 above presents the results of the calculation of the VPR method using the SAP application and can be conveyed as follows:

a. Delivery Score Criteria

In the delivery score criteria column, it can be seen that the one with the highest value is CV A (100) where this indicates that CV A in the assessment time range has entered factory materials/spare parts faster or can be interpreted on time according to the schedule that has been agreed on in the Purchase Order (PO). For the lowest value is CV B (9.76), this indicates that CV IH does not have a good commitment in terms of supplying factory materials/spare parts on time, where in the predetermined performance assessment time range almost all materials/factory parts that have been PO to CV B delivery time (delivery time of goods/materials) is late. Likewise with CV D, CV E and CV C, although the Delivery Score value is not very good, it can be interpreted that they still have a commitment to supply spare parts/materials on time even though there are still spare parts materials that are supplied beyond the time that has been agreed at the PO.

b. Quality Score Criteria

Looking at the Quality Score column, there are three companies that have the highest nila score (100), namely CV A, CV B and CV E, this indicates that all the spare parts materials that are upplayed are in accordance with the demand specifications and can be accepted by Quality Control ("QC") and users. For CV D (85.86) and CV C (96.19), this indicates that there are still materials that are supplied with Accept with Note in the assessment time range.

c. Price Score Criteria

In the price score column, the value obtained by all partners is almost the same or even, indicating that the Supplier provides a price quote for factory parts to the Procurement Department of goods and services, fluctuations are almost even, sometimes it can exceed the Owner Estimate (OE) that has been determined or can be below the OE.

d. Reqution For Quetation (RFQ) Score Criteria

In the RFQ score criterion column, almost all suppliers have an equal value and the value is not good, this indicates that the supplier's response to the price offer is not very good, this can be because they sometimes do not get the price for the goods offered or they are late in

getting the price from their distributors so that they cannot enter the offer for the spare parts offered by the Procurement Department of Goods and Services of PT PIM.

Other Score Criteria

The Other Score criterion is a partner's response to PT PIM's requests, either in daily communication about the procurement process of goods and services or in fulfilling requests from PT PIM for the supply of goods in terms of accelerating the supply of goods. It is evident from the other score column above that all partners have almost the same value, this indicates that the communication of partners with buyers in the Department of Procurement of Goods and Services is good.

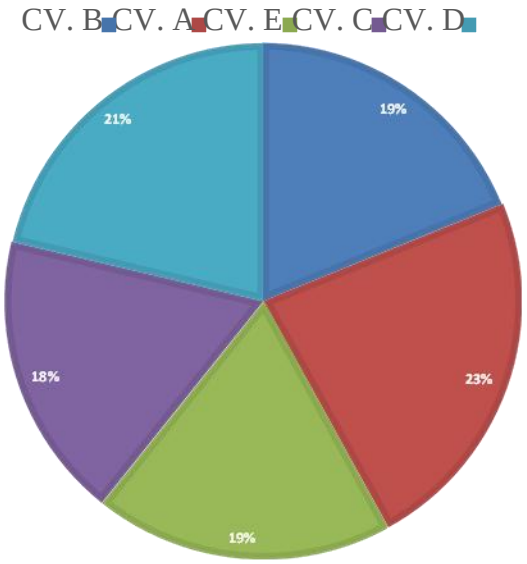

Figure 2. SAP Application Assessment Results Diagram
Source: PT Pupuk Iskandar Muda secondary data, 2023

Overall, the results of the supplier performance assessment are based on the data from table 5 above which is illustrated in the form of a graph so that from the data it can be seen the ranking of suppliers who have the best performance to suppliers whose performance weight score is the lowest, namely:

1. CV A has the highest VPR value with a value of 89.05 (23%), this is because CV A during the performance assessment period has good performance, especially in terms of Delivery, Quality and Other.
2. CV D as the 2nd rank which has a VPR value of 81.90 (21%), in the assessment period CV D has a good performance, especially in terms of the response of partners to buyer demand, but in other aspects it also gets good scores.
3. CV B is next in 3rd position with a VPR value of 73.48 (19%), CV B in the performance assessment period gets a fairly good score in terms of quality and responsiveness but do not be bad performance value in terms of delivery where many goods are late in supply and also not good performance in terms of response to RFG or offers.
4. CV E as the 4th rank has a VPR value of 72.86 (18%) For the performance of CV E suppliers, the performance value during the evaluation period is almost the same as CV B, which is quite good in terms of quality and responsiveness, but quite bad in terms of offer,

where many of these suppliers do not respond to offers during the assessment period.

5. CV C as the last rank with a VPR value of 78.17 (16%), this partner has a poor score compared to other partners who are assessed, this can be seen from the criteria assessed, Delivery, Rfq and Responsive get unsatisfactory scores.

Calculate the Mean Absolute Percentase Error or MAPE value to find out how much error percentage is obtained from the performance weight calculation data using this VPR method, and the results are obtained as described in the following table:

Table 2. Mean Absolute Percentage Error (MAPE) for VPR Weights

Actual (Average Criteria)	Prediction	MAP Criteria	*Absolute*
89,05	100	-10,95	**10,95**
81,90	100	-18,10	**18,1**
73,48	100	-26,52	**26,52**
72,86	100	-27,14	**27,14**
68,17	100	-31,83	**31,83**
MAPE VALUE			**22,908**

Source: Processed from Table 1, 2025 data

With a MAPE value of 22.908% and in the range of 20%-50%, according to Lewis (1982) the error data is "NORMAL" and can be used.

Data Performance Weighted Results with the AHP Method

1. Hierarchy Arrangement

In this study, the criteria or sub-criteria are explained as shown in figure 6 below. This preparation aims to solve the unstructured complex condition into several components in a hierarchical arrangement with a subjective value approach about the relative importance of each variable and determine which variables have the highest priority to influence the outcome in that situation.

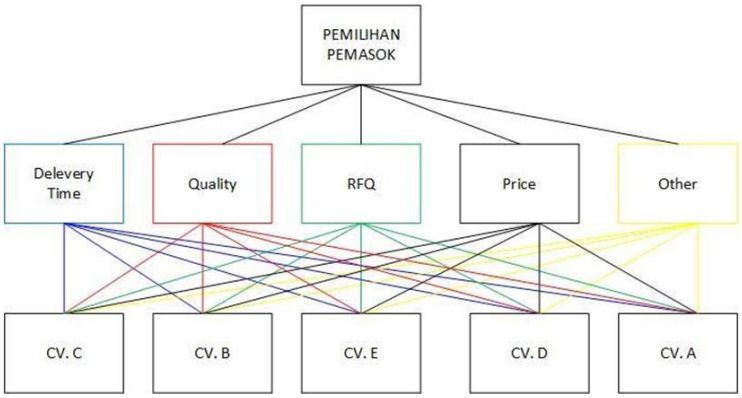

Figure 3. Hierarchical Structure of supplier selection problems

Source: Developed for this study based on assessment criteria, 2025

Based on the diagram in Figure 3, the hierarchy in one structure with several levels in this study is arranged with the first level being a hierarchy with the aim of choosing the best supplier, followed by the level of the criteria factor which is the determining criterion for the assessment and the next level which is the alternative supplier to be assessed.

2. Weighting criteria with AHP

The weighting for each supplier assessment criteria is determined which is then analyzed using the AHP (Analytical Hierarchy Process) method.

3. Create a comparison matrix

After the criterion weighting stage, the preparation of a paired comparison matrix provides an overview of the relative contribution of each element to each objective of the same level of criteria in order to obtain the assessment weight of each variable, then a table of the paired comparison assessment scale is made which is presented in the appendix of this paper.

4. Calculating Pairs Comparison Matrices

In this study we have 5 (five) criteria, where the criteria (K) are Other, RFQ, Delivery Time, Price and Quality. The value in this paired comparison matrix is based on the decision-maker assessment process which is the result of comparing the level of importance in each criterion against other criteria. The preparation of a comparison matrix using excel aims to compare each criterion to achieve the outcome goal. In weighting the level of importance, the law of reciprocal axiom applies, which means that the paired comparison matrix formed must be inversely incorrect. If an element A is considered important compared to element B, then the value of B is 1/A compared to the value of A and if the value of A is as important as the value of B, then each of them has a value = 1.

Table 3. Comparison of priority pairs criteria

	Other	RFQ	Delivery Time	Price	Quality
Other	1	0,3333	0,3333	0,2000	**0,1429**
RFQ	3	1	0,5000	0,3333	**0,2000**
Delivery Time	3	2	1	0,3333	**0,2000**
Price	5	3	3	1	**0,2500**
Quality	7	5	5	4	**1**
Total	**19**	**11,33333333**	**9,833333333**	**5,866666667**	**1,792857143**

Source: Primary data of PT PIM's internal respondent questionnaire, 2025

From Table 3, the data of the same comparison criteria are presented and the other values are the opposite. An example of an RFQ scoring with Other is inversely biased where the RFQ value is 3 and Other is 0.3333 which means that the RFQ is moderately important than Other.

5. Calculating the value of the normalization eigen

Normalize each column by dividing each value of the i-column and the j-row by the largest value in column i. The data used is the data in table 7.

Table 4. Own Normalization

	Other	RFQ	Delivery Time	Price	Quality
Other	0,0526	0,0294	0,0339	0,0341	**0,0797**
RFQ	0,1579	0,0882	0,0508	0,0568	**0,1116**
Delivery Time	0,1579	0,1765	0,1017	0,0568	**0,1116**
Price	0,2632	0,2647	0,3051	0,1705	**0,1394**
Quality	0,3684	0,4412	0,5085	0,6818	**0,5578**
Total	**1**	**1**	**1**	**1**	**1**

Source: Processed from Table 3 data, 2025

The value of a1 1 is the normalization value of each column by dividing the 1st column with the 1st row for the Other criterion with the total Other value in Table 1 so that a value of 0.0526 is obtained. This calculation is repeated by dividing the value of each i-column and the j-row by the largest value in column i as shown in Table 4 above.

6. Eigen vector, coherence tested and MAPE calculation

Calculating the Eigenvector using equation 5 with the data from the calculation results of Table 3 and Table 4 above, the EigenValue (λ) value is obtained as presented from Table 5 below:

Table 5. EigenValue (λ) calculation table

	P. Vector	Weight	*Own Value*
Other	0,2297	0,0459	**0,8729**
RFQ	0,4653	0,0931	**1,0548**
Delivery Time	0,6044	0,1209	**1,1887**
Price	1,1428	0,2286	**1,3409**
Quality	2,5577	0,5115	**0,9171**
Total	**5**	**1**	**5,3745**

Source: Processed from Table 3 and Table 4 data, 2025

Table 6. Mean Absolute Percentage Error (MAPE) for VPR Weights

Actual (Average Criteria)	Target	MAPE Criteria	Absolute
0,08	0,1	-3,28	**3,28**
MAPE VALUE			**3,28**

Source: Processed from AHP calculation data, 2025

With a MAPE score of 3.28% and in the range <10% of the error data is "Very Accurate".

7. Weighting Criteria

To ascertain the weighted value of each criterion with supplier alternatives is presented in the following table:

a. Delivery Time Criteria

Table 7. Value of Paired Comparison Matric Delivery Time Criteria

SUPPLIERS	CV C	CV B	CV E	CV D	CV A
CV C	1	3,0000	3,0000	3,0000	**0,2000**
CV B	0,3333	1	0,2500	0,2500	**0,2000**
CV E	0,3333	4	1	0,2500	**0,2000**
CV D	0,3333	4	4	1	**0,2000**
CV A	5	5	5	5	**1**
Total	**7**	**17**	**13,25**	**9,5**	**1,8**

Source: Primary data of PT PIM's internal respondent questionnaire, 2025

The data from the calculation results of Table 7 above is the value of the paired comparison matrix for the RFQ criterion where the value obtained is from the results of the questionnaire where CV C is higher than CV B so that in this criterion moderate CV C is more important than CV B.

Table 8. Weight Value Delivery Time Criteria

	P. Vector	Weight
CV C	0,9726	**0,1945**
CV B	0,2627	**0,0525**
CV E	0,4958	**0,0992**
CV D	0,8012	**0,1602**
CV A	2,4676	**0,4935**
Total	**5**	**1**

Source: Processed from Table 7, 2025 data

Determine the criterion weight value for the Delivery Time criterion, where the Vector Priority value is obtained from the sum of each row for the alternative, where for the CV C supplier alternative with a value of 0.9726. While the value of the weight obtained from the value of Vector Priority divided by n matrix, for the CV C supplier alternative with a value of 0.1945. This calculation is repeated for all supplier alternatives.

b. Quality Criteria

Table 9. Paired Comparison Matrix Value on Quality Criteria

SUPPLIERS	CV C	CV B	CV E	CV D	CV A
CV C	1	0,2000	0,2000	0,2000	**1,0000**
CV B	5	1	3,0000	3,0000	**5,0000**
CV E	5	0,333333333	1	1,0000	**3,0000**
CV D	5	0,333333333	1	1	**0,5000**
CV A	1	0,2	0,333333333	2	**1**
Total	**17**	**2,066666667**	**5,533333333**	**7,2**	**10,5**

Source: Primary data of PT PIM's internal respondent questionnaire, 2025

The data from the calculation results of Table 8 above is the value of the paired comparison matrix for the RFQ criterion where the value obtained is from the results of the questionnaire where CV B is higher than CV C so that in this criterion CV B moderate is more important than CV C.

Table 10. Value Weights Quality Criteria

	P. Vector	Weight
CV C	0,3148	**0,0630**
CV B	2,2130	**0,4426**
CV E	1,0607	**0,2121**
CV D	0,8226	**0,1645**
CV A	0,5889	**0,1178**
Total	**5**	**1**

Source: Processed from data Table 9, 2025

Determine the criterion weight value for the Quality criterion, where the Vector Priority value is obtained from the sum of each row for the alternative, where for the CV C supplier alternative with a value of 0.3148. While the weight value is obtained from the Vector Priority value divided by n matrix, for the CV C supplier alternative with a value of 0.030. This calculation is repeated for all supplier alternatives.

c. Price Criteria

Table 11. Paired Comparison Matrix Value on Price Criteria

SUPPLIERS	CV C	CV B	CV E	CV D	CV A
CV C	1	0,3333	1,0000	1,0000	**0,2000**
CV B	3	1	0,5000	0,5000	**0,2000**
CV E	1	2	1	0,5000	**0,2000**
CV D	1	2	2	1	**0,2000**
CV A	5	5	5	5	**1**
Total	**11**	**10,33333**	**9,5**	**8**	**1,8**

Source: Primary data of PT PIM's internal respondent questionnaire, 2025

The data from the calculation results of Table 11 above is the value of the paired comparison matrix for the RFQ criterion where the value obtained is from the results of the questionnaire where CV B is higher than CV C so that in this criterion moderate CV B is more important than CV C.

Table 12. Weight Value Price Criteria

	P. Vector	Weight
CV C	0,4645	**0,0929**
CV B	0,5957	**0,1191**
CV E	0,5633	**0,1127**
CV D	0,7311	**0,1462**
CV A	2,6453	**0,5291**
Total	**5**	**1**

Source: Processed from Table 11, 2025 data

Determine the criterion weight value for the Price criterion, where the Vector Priority value is obtained from the sum of each row for the alternative, where for the CV C supplier alternative with a value of 0.4645. While the weight value is obtained from the value of Vector Priority divided by n matrix, for the CV C supplier alternative with a value of 0.0929. This calculation is repeated for all supplier alternatives.

d. RFQ Criteria

Table 13. Paired Comparison Matrix Values on RFQ Criteria

SUPPLIERS	CV C	CV B	CV E	CV D	CV A
CV C	1	3,0000	0,2000	0,2000	**0,2000**
CV B	0,333	1	0,2000	0,2000	**0,2000**
CV E	5	5	1	0,2500	**0,2000**
CV D	5	5	4	1	**0,2000**
CV A	5	5	5	5	**1**
Total	**16,33333**	**19**	**10,4**	**6,65**	**1,8**

Source: Primary data of PT PIM's internal respondent questionnaire, 2025

The data from the calculation results of Table 12 above is the value of the paired comparison matrix for the RFQ criterion where the value obtained is from the results of the questionnaire where CV C is higher than CV B so that in this criterion moderate CV C is more important than CV B

Table 14. Weighted Value of RFQ Criteria

SUPPLIERS	P. Vector	Weight
CV C	0,3795	**0,0759**
CV B	0,2335	**0,0467**
CV E	0,8141	**0,1628**
CV D	1,2154	**0,2431**
CV A	2,3575	**0,4715**
Total	**5**	**1**

Source: Primary data of PT PIM's internal respondent questionnaire, 2025

Specifies the value of the criterion weight for the RFQ criterion, where the Vector Priority value is obtained from the sum of each row for the alternative, where for the CV supplier alternative C with a value of 0.3795. While the weight value is obtained from the value of Vector Priority divided by n matrix, for the alternative supplier CV C with a value of 0.0759. This calculation is repeated for all supplier alternatives.

e. Other Criteria

Table 15. Paired Comparison Matrix Value on Other Criter**ia**

SUPPLIERS	CV C	CV B	CV E	CV D	CV A
CV C	1	3	0,2500	0,2500	**0,2000**
CV B	0,3333	1	0,3333	0,3333	**0,2000**
CV E	4	3	1	3	**0,3333**
CV D	4	3	0,3333	1	**0,3333**
CV A	5	5	3	3	**1**
Total	**14,3333**	**15**	**4,9167**	**7,5833**	**2,0667**

Source: Processed from Table 14 data, 2025

The data from the calculation results of Table 14 above is a paired comparison matrix value for the other criterion where the score obtained is from the results of the questionnaire where CV C is higher than CV B, so that in this criterion moderate CV C is more important than CV B.

Table 16. Other Criteria Weights

SUPPLIERS	P. Vector	Weight
CV C	0,4504	**0,0901**
CV B	0,2984	**0,0597**
CV E	1,2394	**0,2479**
CV D	0,8400	**0,1680**
CV A	2,1718	**0,4344**
Total	**5**	**1**

Source: Recapitulation of the results of the calculation of the weights of all criteria, 2025

Determine the criterion weight value for the Other criterion, where the Vector Priority value is obtained from the sum of each row for the alternative, where for the CV C supplier alternative with a value of 0.4504. While the weight value is obtained from the Vector Priority value divided by n matrix, for the CV C supplier alternative with a value of 0.0901. This calculation is repeated for all supplier alternatives.

8. Priority Suppliers

The final result for excel application in calculating supplier performance is to determine the value of the final priority weight, this value will be used to make a decision. This final result is obtained from the relative weight of the decision-making elements.

The table below will explain the results of the decision calculation which is the last stage in the measurement of supplier performance. The table can show which suppliers have the best performance or performance and vice versa which suppliers have low performance or below the company's target.

Table 17. Weighted Value Criteria

	Delivery Time	Quality	Price	RFQ	Other
CV C	0,1945	0,0630	0,0929	0,0759	**0,0901**
CV B	0,0525	0,4426	0,1191	0,0467	**0,0597**
CV E	0,0992	0,2121	0,1127	0,1628	**0,2479**
CV D	0,1602	0,1645	0,1462	0,2431	**0,1680**
CV A	**0,4935**	**0,1178**	**0,5291**	**0,4715**	**0,4344**

Source: Recapitulation of the results of the calculation of the weights of all criteria, 2025

The data from Table 17 is a summary of the results of the calculation of the values of all the weights of all criteria. To get a supplier that is a priority, it is obtained by multiplying the results of the calculation of the value of the criterion weight and the priority weight of the criteria with the results as shown in table 18 below:

Table 18. Weighted Value Criteria

	Delivery Time	Quality	Price	RFQ	Other	SHOES	% Weight	Rank
CV C	0,0235	0,0322	0,0212	0,0071	0,0041	0,0882	9%	**5**
CV B	0,0064	0,2264	0,0272	0,0043	0,0027	0,2671	27%	**2**
CV E	0,0120	0,1085	0,0258	0,0152	0,0114	0,1728	17%	**3**
CV D	0,0194	0,0842	0,0334	0,0226	0,0077	0,1673	17%	**4**
CV A	**0,0597**	**0,0602**	**0,1209**	**0,0439**	**0,0200**	**0,3047**	**30%**	**1**

Source: Processed from the multiplication of the weight of the criterion by the alternative weight, 2025

From the results of the calculation of the supplier's performance weight using the AHP method above, it can be defined as follows:

a. Weight Delivery Criteria

In the delivery criteria column, it can be seen that the one with the highest weight is CV A (0.0597) where this indicates that the assessment of the correspondent (business person) who is interviewed against CV A, that CV A has a fairly good commitment in supplying goods and there are rarely delays in accordance with the agreement on the PO obtained, but CV B gets the lowest weight value (0.0064) this indicates that the correspondent's assessment of the supply of goods carried out by CV B is not good, in the sense that CV B is often late in supplying goods in accordance with PO's commitment.

b. The Importance of Quality Criteria

Looking at the Quality criterion weight column, the one that received the highest criterion

weight was CV B (0.2264) in this case the correspondent viewed CV B positively in terms of the quality of the spare parts supplied, this indicates that the spare parts supplied by CV B are in accordance with the requested specifications and original. In contrast to CV B, CV C has the lowest weight, which is (0.0322) which means that correspondents consider CV C to often have problems in supplying goods in the sense that the supplied material is often not in accordance with the requested specifications or there is often re-supply

c. Price Criteria

In the weight column of the price criteria obtained by the four companies (CV C, CV B, CV E and CV D) almost the same or evenly, this indicates that the correspondents consider that the four companies in providing price quotes give almost the same assessment, but in contrast to CV A where almost all correspondents give very positive tilapia in the price quotes given by this company, in the sense that in the process of procuring CV, this CV always provides the best price in the process of procurement of tribal goods reserves. So that in the weight of the Price criterion, CV A gets the highest score weight, which is (0.1209)

d. Reqution For Quetation (RFQ) Criteria

In the weight column of the RFQ criteria, CV A received a positive response from correspondents and received the highest weight from other suppliers (0.0439), this indicates that CV A's response to the RFQ given by PT PIM to them was quite good compared to other suppliers. While CV B received the lowest weight value in the RFQ criterion (0.0043), it can be concluded that the correspondent gave a poor score compared to other suppliers in this category, it could be that CV B responded to the price offer given by PT PIM to CV B so that the correspondents gave an unsatisfactory value.

e. Bobot Kriterian Other

Other Criterion Weight is the supplier's response to the procurement process of goods at PT PIM, both in daily communication of the procurement process of goods and services or the fulfillment of requests from PT PIM for the supply of goods in terms of accelerating the supply of goods. Judging from the other score weight column above, CV A received the highest score (0.0200), this indicates that the communication of this supplier in the process of procurement of goods and services is going quite well, both in terms of accelerating the entry of spare parts or daily communication and correspondents consider it quite good. The opposite indication is experienced by CV B which has the lowest weight (0.0027).

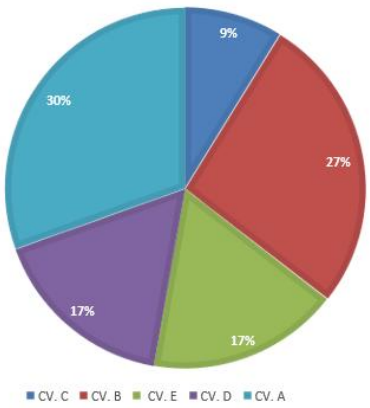

Figure 4. Supplier Performance Measurement Graph
Source: Processed from Table 18, 2025 data

From Figure 4 and table 18, which are two visuals of total weight score data are depicted in the form of graphs and tables. From this data, it can be seen the ranking of suppliers with the best performance to suppliers with the lowest performance.

Based on the data on the results of the supplier's performance measurement above, the results can be as follows:

1. CV A has the highest priority weight of 30% with a weight value of 0.3047
2. CV B as the 2nd rank has a priority weight of 27% with a weight value of 0.2771
3. CV E as the 3rd rank has a priority weight of 17% with a weight value of 0.1728
4. CV D as the 4th rank has a priority weight of 17% with a weight value of 0.1673
5. CV C as the 5th rank has a priority weight of 9% with a weight value of 0.0822

Comparison between the Vendor Performance Rating method and the Analytic Hierarchy Process

The comparison between the Vendor Performance Rating (VPR) method and the Analytic Hierarchy Process (AHP) will provide a comprehensive and structured approach to the supplier selection process, enabling companies to make better and data-driven decisions and assessments.

These two methods have their own advantages that can provide added value in the evaluation and supplier selection process:

1. Advantages of the Vendor Performance Rating (VPR) Method:

a. VPR focuses more on supplier performance, where VPR allows for a direct evaluation of the supplier's actual performance based on predetermined criteria. This provides a deeper understanding of how suppliers perform in real-world situations.
b. By using VPR, supplier performance assessments can be more flexible and real time and companies can regularly monitor supplier performance and identify trends or patterns that emerge over time. This allows the company to take corrective actions or improvements if needed and in real-time.
c. VPR provides a clear and structured framework for evaluating supplier performance. This helps ensure that the assessment process is conducted objectively and transparently.

2. Advantages of the Analytic Hierarchy Process (AHP) Method:

a. The AHP provides a hierarchical framework that allows for hierarchical modeling of the assessment criteria. It helps in a better understanding of the relationship between different criteria and facilitates the decision-making process.
b. AHP uses consistency in decision-making to ensure that the preferences expressed by users are not conflicting or inconsistent. This helps to produce more trustworthy decisions.
c. AHP provides a mathematical approach to determining the relative weights of different criteria. This allows for more measurable and objective decision-making.
d. The AHP can be easily adapted to different situations or environments. This allows users to change the criteria or hierarchical structure according to their specific needs.

Table 19. Comparison of MAPE values for both Methods (VPR & AHP)

MAP	VPR	AHP	DIFFERENCES
	22,91 %	**3,28%**	**19,63%**

Source: Recapitulation of MAPE calculation results, 2025

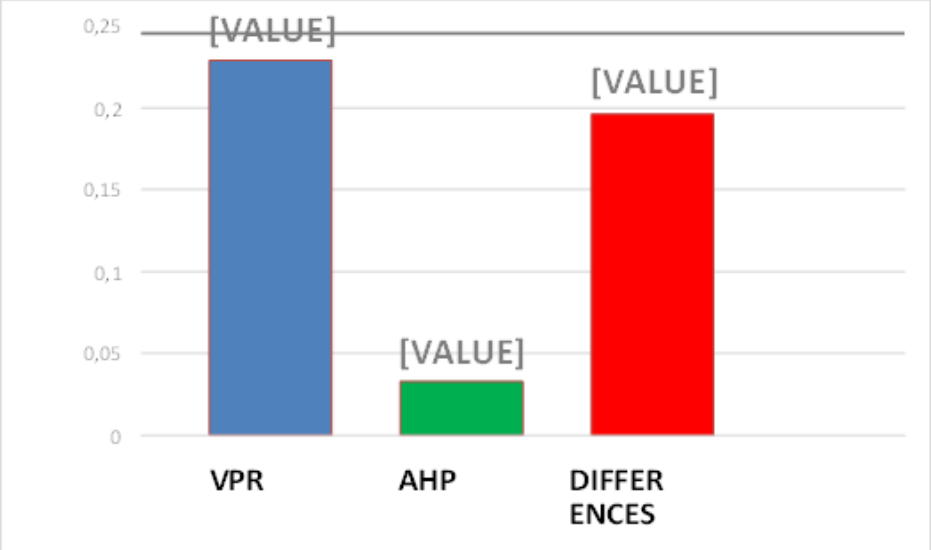

Figure 5. Comparison Chart of MAPR Values VPR and AHP Methods
Source: Processed from Table 20, 2025 data

From Table 18 and Figure 5 above, it can be conveyed that the MAPE value produced by AHP is more accurate than the MAPE value obtained in the VPR method because the smaller the MAPE value is in the The data error rate is getting smaller and more accurate so that the results obtained can be more accurate.

Table 20. Comparison of Supplier Performance Using VPR and AHP Methods

NO	SUPPLIERS	VPR METHOD	AHP METHOD	DIFFERENCES WEIGHT
1	CV A	89.05 (23%) Priority 1	0.3047 (30%)Priority 1	**7%**
2	CV D	81.90 (21%) Priority 2	0.1673 (17%)Priority 4	**4%**
3	CV B	73.48 (19%) Priority 3	0.2771 (27%) Priority 2	**8%**
4	CV E	72.86 (18%) Priority 4	0.1728 (17%) Proiritas 3	**1%**
5	**CV C**	**78.17 (16%) Priority 5**	**0.0822 (9%) Priority 5**	**7%**

Source: Recapitulation of VPR and AHP analysis results, 2025

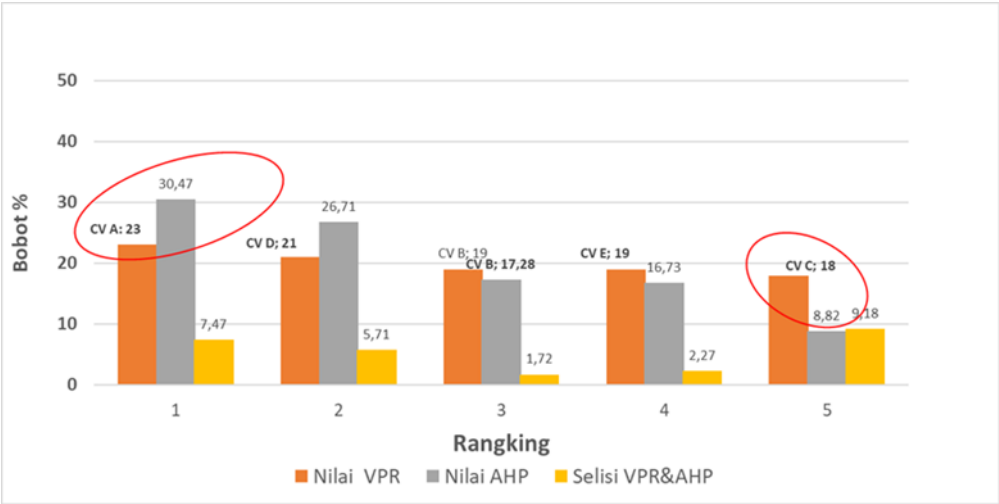

Figure 6. Graph of Supplier Performance Evaluation Results with Two Methods
Source: Processed from Table 20, 2025 data

Judging from Table 19 and Figure 9, the results of the supplier performance evaluation for the two methods are the VPR and AHP motes, for the 1st and last rankings are the same suppliers and for results 2, 3 and 4 there are different rankings, this is due to the assessment of business people on the performance of the supplier is different. However, the performance assessment of suppliers who occupy the first and last ranks is the same.

CONCLUSION

The analysis of five spare parts suppliers at PT Pupuk Iskandar Muda showed that CV A consistently achieved the best performance using both the VPR and AHP methods, while CV C ranked lowest. In the VPR method, CV A obtained the highest score (89.05; 23%), followed by CV D, CV B, CV E, and CV C, whereas in the AHP method, CV A also ranked first with a priority weight of 30% (0.3047), followed by CV B, CV E, CV D, and CV C. These findings indicate that high-performing suppliers tend to receive consistent evaluations across different methods. Although the AHP method demonstrated higher accuracy based on MAPE values, the VPR method was found to be more practical and easier to implement. Therefore, combining both methods is recommended to enhance decision-making accuracy, particularly in supplier evaluation and recognition processes. Future research is suggested to include a larger number of suppliers and additional evaluation criteria, as well as to explore the integration of other multi-criteria decision-making methods to further improve the robustness and reliability of supplier performance assessments.

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