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Analysis of Vendor Performance Based on Vendor Performance Indicator (VPI) Through Analytical Hierarchy Process (AHP) Method at PT. MMG

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Abstract

This research aims to design and implement a systematic and data-driven vendor performance measurement system at PT Multi Mitra Guna, which previously had no formal method to assess vendor performance. Performance measurement was conducted using five main criteria: Quality, Cost, Delivery, Flexibility, and Responsiveness. The Analytic Hierarchy Process method was applied to objectively assign weights to each criterion and sub-criterion through a pairwise comparison questionnaire completed by six respondents from relevant divisions. Vendor performance assessment was subsequently conducted using the Vendor Performance Indicator with a Likert scale. The findings show that PT. YBJ achieved the highest final score (0.331), followed by PT. LAR (0.235) and PT. SBR (0.222). Consequently, PT. YBJ is selected as the primary vendor, PT. LAR as the second option, and PT. SBR requires further evaluation. It is recommended that the AHP and VPI methods be applied periodically to maintain objectivity and consistency in future vendor assessments.

Keywords: Vendor Performance, Vendor Performance Indicator (VPI), Analytical Hierarchy Process (AHP)

1. Introduction

In the current era of globalization, rapid technological developments have led to the emergence of numerous new companies and intensified competition across industries. Companies that effectively combine strategy, technology, and resources are better positioned to sustain competitive advantage (Fauzi, 2023). Fundamentally, all companies share a common business objective: to maximize profit while minimizing operational costs (Khusairi & Munir, 2015). Achieving this goal requires rigorous assessment of vendors or suppliers, as effective vendor performance management supports companies in reducing supply risks, optimizing costs, and strengthening partnerships. Several methods and indicators have been developed to evaluate vendor performance, including the Quality, Cost, Delivery, Flexibility, and Responsiveness (QCDFR) framework (Syifa & Nurhasanah, 2023).

In the vendor performance evaluation process, the Analytical Hierarchy Process (AHP) method is applied to support multi-criteria decision making by determining the relative weight of each performance indicator (Noviani et al., 2021). This approach enables companies to select the best vendor in a structured and evidence-based manner.

The purpose of this research is to design and implement a structured, data-based vendor performance appraisal system at PT Multi Mitra Guna (MMG), which previously lacked a formal vendor evaluation mechanism. Practically, this research enables MMG to improve operational efficiency and competitiveness. Theoretically, it contributes to the body of knowledge on the combined application of AHP — developed by Prof. Thomas L. Saaty in the 1970s — and the Vendor Performance Indicator (VPI), and can serve as a reference for future scholarly inquiry.

Although the integration of AHP and VPI has been applied in several prior vendor evaluation studies (e.g., Sukendar et al., 2021; Heitasari et al., 2024; Adi Mukti & Ulfah Afifah, 2024), these studies have largely replicated the standard procedure in different organizational settings without examining the robustness of the resulting vendor ranking or translating the weighting outcomes into concrete managerial action. This study addresses these limitations in two ways. First, it extends the AHP-VPI framework with a sensitivity analysis to verify whether the criteria weights derived from a small, high-authority respondent group produce a stable vendor ranking, a robustness check rarely reported in comparable studies. Second, it explicitly links the resulting criteria weights to managerial implications

for supplier development and supply chain risk management at MMG, a company that, prior to this research, had no formal vendor evaluation system in place. In doing so, the study contributes not only an empirical application but also methodological reinforcement and a managerially actionable interpretation of AHP-VPI outcomes for the vendor management literature.

2. Theory Overview

2.1 Vendor Performance Measurement

Vendor performance measurement is a critical and structured process intended to provide companies with reliable information for supplier selection and management decisions (Nurjanah & Fatmawati, 2020). By systematically evaluating suppliers, companies can enhance product and service quality, identify operational efficiencies, and build mutually beneficial working relationships. The criteria applied in this evaluation include Quality, Cost, Delivery, Flexibility, and Responsiveness (QCDFR) (Syifa & Nurhasanah, 2023).

2.2 Vendor Performance Indicator (VPI)

A vendor is broadly defined as a third party in the supply chain — a seller who offers goods or services to a company for production use or resale (Resdiana & Afifah Zahirah, 2019). The Vendor Performance Indicator (VPI) serves to establish criteria and sub-criteria that are relevant to the company's procurement needs (Rochmoeljati, 2006). Through regular VPI monitoring, companies can provide constructive feedback and encourage continuous improvement in supplier partnerships.

2.3 Analytical Hierarchy Process (AHP)

The Analytical Hierarchy Process (AHP), developed by Thomas L. Saaty in the 1970s, is a structured technique for organizing and analyzing complex multi-criteria decisions. AHP determines the relative importance of a series of activities and is widely applied in vendor performance measurement studies due to its relative ease of use and adaptability to multiple criteria and sub-criteria (Andalia & Pratiwi, 2018). The method relies on a functional hierarchy with human perception as the primary input, enabling systematic synthesis of expert judgments (Sasongko et al., 2017).

The hierarchical structure in this study consists of four levels: (1) the goal level — vendor performance measurement; (2) the criteria level — Quality, Cost, Delivery, Flexibility, and Responsiveness; (3) the sub-criteria level; and (4) the alternatives level — the list of vendors under evaluation.

2.4 Research Gap and Positioning of the Study

Prior studies combining AHP and VPI for vendor evaluation converge on several methodological choices but also share recurring limitations. Sukendar et al. (2021) and Heitasari et al. (2024) confirm Quality as the dominant criterion across different industrial contexts, yet neither study tests whether this dominance persists under plausible variation in expert judgments. Noviani et al. (2021) and Andalia and Pratiwi (2018) apply AHP to supplier selection but report criteria weights without connecting them to specific managerial actions such as supplier development programs or risk mitigation strategies. Deretarla et al. (2023) extend AHP with a complementary multi-criteria technique to improve ranking robustness, signaling a broader methodological trend toward strengthening the reliability of AHP-VPI outcomes, a trend this study follows through sensitivity analysis. Taken together, the literature exhibits three recurring gaps: (1) limited testing of ranking robustness, (2) underdeveloped managerial interpretation of weighting results, and (3) reliance on the AHP-VPI procedure as a standalone technical exercise rather than a tool integrated with broader procurement and supply chain risk management. This study positions itself at the intersection of these three gaps by combining the standard AHP-VPI procedure with a sensitivity check and an explicit managerial interpretation layer, applied within an organizational context that had not previously implemented any formal vendor evaluation system.

3. Research Methods

This study employs a quantitative research approach, which uses numerical data and focuses on measuring objective outcomes through statistical analysis (Sugiyono, 2013). Data were processed using the AHP method through Expert Choice software (Wardhana, 2017). The evaluation criteria for vendor performance comprise Quality, Delivery, Cost, Flexibility, and Responsiveness, with their respective sub-criteria and measurement scales detailed in Table 1.

TABLE 1
VARIABLE OPERATIONALIZATION

Criteria	Definition	Performance Indicator	Scale	Reference
Quality	Vendor's ability to fulfill quality standards (Rochmoeljati, 2019)	Defect Rate; Complaint resolution; Certification compliance	Likert & Pairwise	Rochmoeljati, 2019

Delivery	Vendor's ability to deliver on time (Ihwan, 2024)	On-time delivery; Flexibility in delivery changes; Delivery accuracy	Likert & Pairwise	Ihwan, 2024
Cost	Price level of raw materials offered (Alhabib, 2024)	Competitive pricing; Cost reduction initiatives; Payment term flexibility	Likert & Pairwise	Alhabib, 2024
Flexibility	Vendor's ability to accommodate order and delivery changes (Himawan, 2020)	Volume flexibility; Mix flexibility; Change responsiveness	Likert & Pairwise	Himawan, 2020
Responsiveness	Vendor's ability to respond to problems or requests (Sherly, 2017)	Complaint resolution time; Customer support availability; Problem-solving capability	Likert & Pairwise	Sherly, 2017

(Source: Data processed by researchers, 2025)

Primary data were collected through two types of questionnaires: (1) a pairwise comparison questionnaire based on the AHP Saaty scale (1–9) to determine criterion weights, and (2) a Likert scale questionnaire (1–5) based on the VPI to assess each vendor's actual performance. Both instruments were distributed to six respondents: Procurement Manager, Procurement Staff I, Procurement Staff II, Finance Staff, Electrical Staff I, and Electrical Staff II. A saturated sampling technique was applied given the small population size and the respondents' direct authority over the vendor evaluation process. These six respondents were deliberately selected rather than randomly sampled because each holds direct decision-making authority or first-hand operational interaction with the vendors under evaluation: the Procurement Manager and Procurement Staff oversee vendor contracts and negotiations, Finance Staff verify cost and payment performance, and Electrical Staff interact directly with vendor-supplied materials and services in daily operations. This purposive, authority-based selection is consistent with AHP methodology, which prioritizes the judgment quality of a small group of competent experts over the statistical generalizability of a large sample (Sasongko et al., 2017).

3.1 Data Analysis Technique

The data analysis process followed these sequential steps:

(1) Field study. Direct observation at PT Multi Mitra Guna to understand the vendor procurement process.

(2) Problem identification. Since MMG had no historical vendor data, a first-time performance survey was conducted using a 1–5 scale.

(3) Criteria determination. Five criteria were established: Quality, Cost, Delivery, Flexibility, and Responsiveness.

(4) Pairwise comparison questionnaire. Distributed based on Saaty's importance scale (Table 2).

(5) AHP weight calculation. Criteria weights were derived through pairwise comparison matrix processing.

(6) Consistency testing. Consistency Ratio (CR) was calculated for all matrices; CR < 0.10 indicates acceptable consistency.

(7) VPI assessment. Vendor scores were collected using the Likert scale and subsequently normalized.

(8) Final vendor score calculation. The final score was computed as the weighted sum of normalized scores.

TABLE 2
SAATY SCALE: LEVEL OF IMPORTANCE

Level	Definition	Description
1	Equal importance	Both elements have equal influence
3	Moderate importance	Experience slightly favors one element over another
5	Strong importance	Experience and judgment strongly favor one activity over another
7	Very strong importance	Demonstrated dominance of one activity over another
9	Extreme importance	One element is absolutely preferred at the highest confidence level
2, 4, 6, 8	Intermediate values	Compromise values between adjacent judgments

(Source: Farraz Firza, 2021)

The AHP consistency test employs the Consistency Index (CI) and Consistency Ratio (CR) as follows:

$$CI = (\lambda max - n) / (n - 1) \quad (1)$$

$$CR = CI / RI \quad (2)$$

If CR < 0.10, the matrix is deemed consistent. If CR > 0.10, the pairwise comparisons must be revised.

Matrix normalization and eigenvector (priority weight) calculations follow the standard AHP formulas:

$$Normalized\ value\ (i,j) = a(i,j) / \Sigma\ a(k,j) \quad (3)$$

$$Eigenvector\ (Wi) = (1/n) \times \Sigma\ Normalized\ value\ (i,j) \quad (4)$$

The vendor normalization and final score formulas are:

$$Normalized\ Vendor\ Value = Total\ Vendor\ Score / Highest\ Score\ in\ Criterion \quad (5)$$

$$Final\ Vendor\ Score = \Sigma\ (Wi \times Si) \quad (6)$$

3.2 Instrument Validity and Reliability

Content validity of both instruments was established prior to distribution. The pairwise comparison questionnaire follows the standard AHP Saaty scale structure, and the Likert-scale VPI questionnaire was constructed from the QCDFR criteria and sub-criteria validated in prior vendor performance literature (Rochmoeljati, 2006; Syifa & Nurhasanah, 2023), ensuring that each item corresponds to an established and conceptually grounded performance dimension rather than an ad hoc measure. Both instruments were reviewed for clarity and relevance with the Procurement Manager prior to distribution to confirm that item wording matched the operational vocabulary used at MMG. Reliability of the AHP component was assessed through the Consistency Ratio (CR) for every pairwise comparison matrix, with all CR values below the 0.10 threshold (Table 7), indicating internally consistent and reliable expert judgments. Because the VPI questionnaire was administered to a small, purposively selected respondent group rather than a large sample, formal internal-consistency statistics such as Cronbach's alpha were not computed; instead, reliability of the VPI scores is supported by the consistency of vendor rankings across all five criteria (Tables 8–12), where PT. YBJ retained the top position in every criterion, indicating stable and non-contradictory respondent judgments.

4. Results and Discussion

4.1 Pairwise Comparison and Criteria Weights

Questionnaires were distributed to six respondents. Following completion, individual responses were aggregated into a single composite matrix using Expert Choice software. Table 3 presents the resulting pairwise comparison matrix for the five main criteria.

TABLE 3
PAIRWISE COMPARISON MATRIX OF CRITERIA (EXPERT CHOICE)

Criteria	Quality	Cost	Delivery	Flexibility	Responsiveness
Quality	1.00	5.41	3.32	6.74	3.50
Cost	1.85	1.00	1.31	2.57	1.71
Delivery	3.01	0.76	1.00	5.06	1.54
Flexibility	1.48	0.39	0.20	1.00	1.85
Responsiveness	2.86	0.58	0.65	0.54	1.00

(Source: Data processed by researchers, 2025)

Following aggregation and eigenvector calculation, the final criteria weights are presented in Table 4.

TABLE 4
CRITERIA WEIGHTS (AHP RESULT)

Criteria	Weight
Quality	0.51
Delivery	0.19
Cost	0.14
Responsiveness	0.11
Flexibility	0.06

(Source: Data processed by researchers, 2025)

Quality received the highest weight (0.51), confirming its dominant role in vendor selection at MMG. This finding is consistent with Sukendar et al. (2021), who reported Quality as the highest-weighted criterion (0.46) in a comparable AHP-based vendor evaluation. Flexibility received the lowest weight (0.06), indicating that respondents consider adaptability in order volume and delivery timing as the least critical factor relative to other performance dimensions. The dominance of Quality over Cost carries direct strategic implications for MMG's procurement policy. Because the respondent group consists primarily of procurement, finance, and operational staff who bear the downstream cost of defects, rework, and certification failures, their judgment reflects a risk-averse procurement posture in which the cost of poor quality is perceived to outweigh potential savings from lower-priced vendors. This pattern supports two managerial actions. First, procurement decisions at MMG should weight vendor quality audits and certification compliance more heavily than price negotiations during vendor selection, rather than treating cost as a co-equal criterion. Second, the result strengthens the case for proactive supplier development: rather than switching vendors solely on cost grounds, MMG should prioritize structured quality-improvement programs (e.g., joint quality audits, defect-rate monitoring, and certification support) with

existing vendors, since the AHP weighting indicates that such interventions would have the largest marginal effect on overall vendor performance scores. From a supply chain risk management perspective, the low weight assigned to Flexibility (0.06) also signals a residual exposure: MMG's evaluation system currently under-weights a vendor's ability to absorb demand volatility, which may leave the company vulnerable to disruption-driven cost increases that the present criteria structure does not fully capture.

4.2 Global Priority Calculation

After obtaining criteria weights, the same AHP process was applied to sub-criteria and vendor alternatives. The resulting global priorities — computed by multiplying the main criterion weight by the local weight of each sub-criterion for every vendor — are presented in Table 5.

TABLE 5
GLOBAL PRIORITY BY CRITERIA, SUB-CRITERIA, AND VENDOR

Criteria	Sub-Criteria	Vendor	Local Priority	Global Priority	Vendor	Local Priority	Global Priority
Quality (0.51)	Defect Rate	PT. YBJ	0.567	0.150	PT. SBR	0.139	0.037
		PT. LAR	0.294	0.078			
	Complaint Resolution	PT. YBJ	0.664	0.096	PT. SBR	0.104	0.015
		PT. LAR	0.231	0.033			
	Certification Compliance	PT. YBJ	0.664	0.061	PT. SBR	0.104	0.010
		PT. LAR	0.231	0.021			
Cost (0.14)	Cost Reduction Initiatives	PT. YBJ	0.661	0.049	PT. SBR	0.090	0.007
		PT. LAR	0.250	0.018			
	Competitive Pricing	PT. YBJ	0.596	0.015	PT. SBR	0.089	0.002
		PT. LAR	0.316	0.008			
	Payment Term Flexibility	PT. YBJ	0.684	0.018	PT. SBR	0.084	0.002
		PT. LAR	0.233	0.006			
Delivery (0.19)	Delivery Accuracy	PT. YBJ	0.595	0.049	PT. SBR	0.142	0.012
		PT. LAR	0.263	0.022			
	On-Time Delivery	PT. YBJ	0.601	0.040	PT. SBR	0.137	0.009
		PT. LAR	0.261	0.018			
	Flexibility in Delivery Changes	PT. YBJ	0.614	0.023	PT. SBR	0.137	0.005
		PT. LAR	0.248	0.009			
Flexibility (0.06)	Volume Flexibility	PT. YBJ	0.469	0.013	PT. SBR	0.317	0.009
		PT. LAR	0.214	0.006			
	Mix Flexibility	PT. YBJ	0.554	0.010	PT. SBR	0.258	0.005
		PT. LAR	0.188	0.003			
	Change Responsiveness	PT. YBJ	0.532	0.010	PT. SBR	0.296	0.005
		PT. LAR	0.171	0.003			
Responsiveness (0.11)	Complaint Resolution Time	PT. YBJ	0.512	0.010	PT. SBR	0.245	0.005
		PT. LAR	0.243	0.003			

Criteria	Sub-Criteria	Vendor	Local Priority	Global Priority	Vendor	Local Priority	Global Priority
	Customer Support Availability	PT. YBJ	0.625	0.021	PT. SBR	0.209	0.007
		PT. LAR	0.166	0.005			
	Problem-Solving Capability	PT. YBJ	0.484	0.027	PT. SBR	0.241	0.014
		PT. LAR	0.275	0.016			
TOTAL	**Total Global Priority**	**PT. YBJ**	—	**0.604**	**PT. SBR**	—	**0.141**
	PT. LAR	—	**0.254**				

(Source: Data processed by researchers, 2025)

Across all sub-criteria, PT. YBJ consistently achieved the highest global priority values, particularly in Defect Rate (0.150), Complaint Resolution Specification (0.096), and Problem-Solving Capability (0.027). This indicates clear superiority in service quality and problem-handling responsiveness. PT. SBR registered the lowest values across most sub-criteria, while PT. LAR occupied an intermediate position, demonstrating relatively stronger performance in Cost Reduction Initiatives and Customer Support Availability.

These findings are consistent with Sukendar and Frinzani (2021), whose AHP results also identified Quality as the dominant criterion (0.46) and Flexibility as the least weighted (0.07). The present study's Quality weight of 0.51 and the cumulative global priority advantage of PT. YBJ (0.604) over PT. LAR (0.254) and PT. SBR (0.141) reinforce the established pattern: quality criteria consistently determine vendor ranking outcomes, while flexibility sub-criteria contribute minimally to the final score.

TABLE 6
TOTAL GLOBAL PRIORITY BY VENDOR

Vendor	Total Global Priority	Rank
PT. YBJ	0.604	1
PT. LAR	0.254	2
PT. SBR	0.141	3

(Source: Data processed by researchers, 2025)

4.3 Consistency Ratio Validation

All Consistency Ratio (CR) values obtained from the AHP pairwise comparisons were below the threshold of 0.10, confirming that the assessment judgments are consistent and that the resulting weights are valid and reliable for decision making. The complete consistency results are presented in Table 7.

TABLE 7
CONSISTENCY RATIO RESULTS (EXPERT CHOICE)

Pairwise Comparison	CR	Status
Between Criteria	0.03	Consistent
Between Sub-Criteria: Quality	0.09	Consistent
Between Sub-Criteria: Cost	0.08	Consistent
Between Sub-Criteria: Delivery	0.07	Consistent
Between Sub-Criteria: Flexibility	0.04	Consistent
Between Sub-Criteria: Responsiveness	0.01	Consistent
Alternatives vs. Defect Rate	0.008	Consistent
Alternatives vs. Complaint Resolution Specification	0.002	Consistent
Alternatives vs. Certification Compliance	0.002	Consistent
Alternatives vs. Competitive Pricing	0.00007	Consistent
Alternatives vs. Cost Reduction Initiatives	0.06	Consistent
Alternatives vs. Payment Term Flexibility	0.06	Consistent
Alternatives vs. On-Time Delivery	0.06	Consistent
Alternatives vs. Flexibility in Delivery Changes	0.04	Consistent
Alternatives vs. Delivery Accuracy	0.04	Consistent
Alternatives vs. Volume Flexibility	0.07	Consistent
Alternatives vs. Mix Flexibility	0.04	Consistent
Alternatives vs. Change Responsiveness	0.08	Consistent
Alternatives vs. Complaint Resolution Time	0.08	Consistent
Alternatives vs. Customer Support Availability	0.06	Consistent
Alternatives vs. Problem-Solving Capability	0.04	Consistent

(Source: Data processed by researchers, 2025)

4.4 Vendor Performance Indicator (VPI) Measurement

VPI measurement integrates the criterion weights derived from AHP with actual vendor performance scores collected via Likert scale (1–5). Tables 8 through 12 present the VPI assessment results for each of the five criteria.

TABLE 8.
VPI MEASUREMENT – QUALITY CRITERION

Respondent	PT. YBJ	PT. SBR	PT. LAR
Operational Manager	12	7	9
Procurement Staff I	13	8	9
Finance Staff	15	11	11
Electrical Staff I	14	10	9
Electrical Staff II	14	9	10
Procurement Staff II	14	10	10
Total Score	**82**	**55**	**58**
Normalization	1.00	0.67	0.71
Final Value (Weight = 0.51)	**0.51**	**0.34**	**0.36**

(Source: Data processed by researchers, 2025)

PT. YBJ obtained the highest total quality score (82), followed by PT. LAR (58) and PT. SBR (55). After normalization against the highest score, PT. YBJ achieved a normalized value of 1.00, yielding a final weighted quality score of 0.51. PT. LAR and PT. SBR received final scores of 0.36 and 0.34, respectively.

TABLE 9
VPI MEASUREMENT – COST CRITERION

Respondent	PT. YBJ	PT. SBR	PT. LAR
Operational Manager	14	8	11
Procurement Staff I	13	10	12
Finance Staff	14	8	10
Electrical Staff I	12	8	10
Electrical Staff II	13	9	11
Procurement Staff II	14	10	9
Total Score	**80**	**53**	**63**
Normalization	1.00	0.66	0.79
Final Value (Weight = 0.14)	**0.14**	**0.09**	**0.11**

(Source: Data processed by researchers, 2025)

PT. YBJ led in the Cost criterion with a total score of 80, while PT. LAR scored 63 and PT. SBR 53. The corresponding final weighted scores are 0.14 (PT. YBJ), 0.11 (PT. LAR), and 0.09 (PT. SBR).

TABLE 10
VPI MEASUREMENT – DELIVERY CRITERION

Respondent	PT. YBJ	PT. SBR	PT. LAR
Operational Manager	14	10	11
Procurement Staff I	14	8	11
Finance Staff	12	7	12
Electrical Staff I	15	9	9
Electrical Staff II	13	10	10
Procurement Staff II	14	9	11
Total Score	**82**	**53**	**64**
Normalization	1.00	0.65	0.78
Final Value (Weight = 0.19)	**0.19**	**0.12**	**0.15**

(Source: Data processed by researchers, 2025)

PT. YBJ recorded the highest delivery score (82), followed by PT. LAR (64) and PT. SBR (53). Final weighted delivery scores are 0.19, 0.15, and 0.12, respectively.

TABLE 11
VPI MEASUREMENT – FLEXIBILITY CRITERION

Respondent	PT. YBJ	PT. SBR	PT. LAR
Operational Manager	13	9	10
Procurement Staff I	14	9	12
Finance Staff	13	8	10
Electrical Staff I	14	12	9
Electrical Staff II	14	8	10
Procurement Staff II	13	9	11
Total Score	**81**	**55**	**62**
Normalization	1.00	0.68	0.77
Final Value (Weight = 0.06)	**0.06**	**0.04**	**0.04**

(Source: Data processed by researchers, 2025)

In the Flexibility criterion, PT. YBJ scored 81, with PT. LAR at 62 and PT. SBR at 55. The low criterion weight (0.06) resulted in final scores of 0.06, 0.04, and 0.04, highlighting the limited contribution of this criterion to the overall vendor score.

TABLE 12
VPI MEASUREMENT – RESPONSIVENESS CRITERION

Respondent	PT. YBJ	PT. SBR	PT. LAR
Operational Manager	14	12	12
Procurement Staff I	14	9	11
Finance Staff	12	8	11
Electrical Staff I	14	11	10

Respondent	PT. YBJ	PT. SBR	PT. LAR
Electrical Staff II	13	8	10
Procurement Staff II	14	9	10
Total Score	**81**	**57**	**64**
Normalization	1.00	0.70	0.79
Final Value (Weight = 0.11)	**0.11**	**0.08**	**0.09**

(Source: Data processed by researchers, 2025)

PT. YBJ achieved the highest responsiveness total (81), followed by PT. LAR (64) and PT. SBR (57). Final weighted scores are 0.11, 0.09, and 0.08, respectively.

4.5 Final Vendor Score Calculation

The final vendor score integrates all five criteria by multiplying each normalized performance score by its corresponding AHP-derived weight, then summing the products (Equation 6). Tables 13, 14, and 15 present the complete calculations for each vendor.

TABLE 13
FINAL SCORE CALCULATION – PT. YBJ

No.	Criteria	Weight	Normalized Score	Score × Weight
1	Quality	0.51	0.51	0.262
2	Delivery	0.19	0.19	0.036
3	Cost	0.14	0.14	0.020
4	Responsiveness	0.11	0.11	0.012
5	Flexibility	0.06	0.06	0.004
	TOTAL	**1.00**		**0.334**

(Source: Data processed by researchers, 2025)

TABLE 14
FINAL SCORE CALCULATION – PT. SBR

No.	Criteria	Weight	Normalized Score	Score × Weight
1	Quality	0.51	0.34	0.173
2	Delivery	0.19	0.12	0.023
3	Cost	0.14	0.09	0.013
4	Responsiveness	0.11	0.08	0.009
5	Flexibility	0.06	0.04	0.002
	TOTAL	**1.00**		**0.220**

(Source: Data processed by researchers, 2025)

TABLE 15
FINAL SCORE CALCULATION – PT. LAR

No.	Criteria	Weight	Normalized Score	Score × Weight
1	Quality	0.51	0.36	0.184
2	Delivery	0.19	0.15	0.029
3	Cost	0.14	0.11	0.015
4	Responsiveness	0.11	0.09	0.010
5	Flexibility	0.06	0.04	0.002
	TOTAL	**1.00**		**0.240**

(Source: Data processed by researchers, 2025)

TABLE 16
FINAL VENDOR PERFORMANCE RANKING

Vendor	Final Score	Rank
PT. YBJ	0.331	1
PT. LAR	0.235	2
PT. SBR	0.222	3

(Source: Data processed by researchers, 2025)

The integrated AHP-VPI analysis produced a clear vendor ranking: PT. YBJ ranked first (0.331), PT. LAR second (0.235), and PT. SBR third (0.222). The dominance of PT. YBJ is driven primarily by its superior quality performance, which — given the criterion's weight of 0.51 — accounts for the majority of the final score differential.

These results align with findings from comparable studies. Sukendar and Frinzani (2021), in their evaluation at PT. Idelux Furniture Indonesia, similarly identified quality as the highest-weighted criterion and found the best-performing vendor holding a significant score advantage over competitors. Heitasari et al. (2024) also reported consistent quality dominance across their integrated VPI-AHP framework. Collectively, these studies confirm that quality criteria are the decisive factor in vendor performance ranking, while flexibility consistently registers the lowest contribution — a pattern replicated in the present study. This recurring pattern can be explained by the nature of MMG's procurement function, which supports electrical and operational equipment where defects or non-conforming materials directly disrupt downstream operations; under such conditions, decision-makers rationally discount price and flexibility advantages that do not compensate for the operational cost of quality failure. The consistency of this pattern across studies conducted in different industries (furniture manufacturing, religious-education infrastructure, and the present electrical procurement context) suggests that Quality dominance in AHP-VPI vendor evaluation may generalize across operationally critical procurement categories, rather than being an artifact specific to any single company. The robustness of this ranking is further confirmed by the sensitivity analysis presented in Section 4.6.

4.6 Sensitivity Analysis

Because Quality carries the largest single weight (0.51) and therefore exerts the greatest influence on the final vendor ranking, a one-at-a-time sensitivity test was conducted to assess whether the ranking of PT. YBJ, PT. LAR, and PT. SBR remains stable under plausible variation in this weight. The Quality contribution to each vendor's final score (Tables 13–15) was perturbed by −20%, −10%, +10%, and +20%, while the contributions of the remaining four criteria were held constant, and the total score was recalculated for each scenario. The results are presented in Table 17.

TABLE 17
SENSITIVITY OF VENDOR RANKING TO QUALITY WEIGHT PERTURBATION

Quality Weight Change	PT. YBJ Score	PT. SBR Score	PT. LAR Score	Resulting Rank Order
-20%	0.282	0.185	0.203	YBJ > LAR > SBR
-10%	0.308	0.203	0.222	YBJ > LAR > SBR
0% (Base Case)	0.334	0.220	0.240	YBJ > LAR > SBR
+10%	0.360	0.237	0.258	YBJ > LAR > SBR
+20%	0.386	0.255	0.277	YBJ > LAR > SBR

(Source: Recalculated by researchers from Tables 13–15, 2025)

The vendor ranking order (PT. YBJ > PT. LAR > PT. SBR) remained unchanged across all five scenarios, including the −20% and +20% perturbations. This indicates that the dominance of PT. YBJ is not an artifact of the specific Quality weight elicited from the respondent group, but reflects a genuine and robust performance gap across the underlying VPI scores. The stability of the ranking under sensitivity testing strengthens the credibility of the AHP-VPI outcome as a basis for MMG's vendor selection decision and addresses the robustness concern that has been left untested in comparable prior studies (e.g., Sukendar et al., 2021; Heitasari et al., 2024).

5. Conclusions and Suggestions

5.1 Conclusion

This research demonstrates that vendor performance evaluation using the Analytical Hierarchy Process (AHP) integrated with the Vendor Performance Indicator (VPI) method yields objective and measurable results. The five main criteria — Quality, Cost, Delivery, Flexibility, and Responsiveness — provided a comprehensive framework for assessing vendor contributions to MMG's supply chain.

PT. YBJ ranked first with the highest final score of 0.331, followed by PT. LAR (0.235) and PT. SBR (0.222). The Quality criterion received the highest weight (0.51), confirming that product and service quality is the most critical determinant in MMG's vendor evaluation. This methodology enables the company to identify vendors worth retaining and those requiring performance improvement, and provides a data-driven basis for supply chain decision making.

5.2 Suggestions

Based on the findings, the following recommendations are proposed:

(1) Retain PT. YBJ as the primary vendor, given its consistently superior performance across all five evaluation criteria.

(2) Designate PT. LAR as an alternative vendor. While its performance is stable, continued improvement in cost efficiency and delivery accuracy is recommended.

(3) Evaluate and provide performance coaching to PT. SBR, particularly in service quality, delivery speed, and responsiveness.

(4) Apply the AHP-VPI measurement system on a periodic basis to sustain objectivity and consistency in vendor selection.

(5) Expand respondent participation to include representatives from additional functional divisions, in order to produce a more comprehensive and representative assessment.

(6) Translate the Quality criterion's dominant weight (0.51) into a formal supplier development program with PT. LAR and PT. SBR, consisting of joint quality audits, defect-rate monitoring with quarterly review, and structured support for certification compliance, rather than relying on vendor switching as the primary corrective mechanism.

(7) Revisit the weighting or definition of the Flexibility criterion in future evaluation cycles, since its currently low weight (0.06) may understate MMG's exposure to supply disruption risk; incorporating a dedicated supply chain risk indicator alongside QCDFR would strengthen the system's risk management function.

(8) Institutionalize the sensitivity-testing procedure introduced in Section 4.6 as a standard step in each periodic AHP-VPI cycle, so that procurement management can confirm the stability of vendor rankings before finalizing contract or sourcing decisions.

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