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Proposed Improvement of the Supplier Selection Process using Analytical Hierarchy Process (AHP) Method: A Case Study of Aircraft MRO in Indonesia

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Abstract
Indonesia's aviation industry has experienced rapid post-pandemic growth, with a 38.5% increase in passenger traffic in 2024 compared to 2022, positioning it as the largest and fastest-growing market in ASEAN. This expansion has intensified demand for Maintenance, Repair, and Overhaul (MRO) services. PT XYZ, Indonesia's leading aircraft maintenance provider, faces procurement issues in acquiring painting materials, causing delays and missed turnaround targets. This study aims to optimize supplier selection through the Analytical Hierarchy Process (AHP), employing a mixed-methods approach involving stakeholder interviews to determine key criteria. The model incorporates six main criteria and fourteen sub-criteria, prioritizing quality, regulatory compliance, reliability, cost, and delivery. The results identified Supplier II as the most suitable option. The study recommends institutionalizing the AHP model within PT XYZ's procurement policy and integrating it into its ERP system, offering a scalable solution for enhancing procurement efficiency and supporting strategic decision-making in aviation MRO operations.
Keywords: Aviation Industry, Supplier Selection, Analytical Hierarchy Process (AHP), Maintenance Repair and Overhaul (MRO), Procurement Strategy

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INTRODUCTION

The Indonesian aviation industry is experiencing remarkable growth, positioning itself as the largest and fastest-growing market in ASEAN. As of 2024, Indonesia recorded a total of 95.13 million passengers, with 65.95 million being domestic travelers and 29.18 million international passengers (Cahyadhi, 2024). This figure represents a substantial 38.5% increase compared to 2022, demonstrating the market's robust recovery post-pandemic. Looking ahead, the Indonesian National Air Carriers Association (INACA) projects that by 2034, Indonesia will rank as the sixth-largest aviation market globally, with an estimated 390 million passengers. This growth underscores the increasing demand for aviation services, including Maintenance, Repair, and Overhaul (MRO) operations, which are vital for maintaining airworthiness and ensuring safety standards across fleets.

Within the aviation ecosystem, several integral components such as airports, ground handling, Air Traffic Control (ATC), flight crew, and passengers coexist with the crucial sector of Maintenance, Repair, and Overhaul (MRO). MRO companies play a central role in aviation safety by providing critical services, including scheduled inspections, urgent repairs, and overhauls of aircraft and engine components. These services are strictly regulated and certified by global authorities such as the Federal Aviation Administration (FAA), European Union Aviation Safety Agency (EASA), and the Directorate General of Civil Aviation (DGCA) of Indonesia. Compliance with these certifications ensures that MRO providers maintain operational excellence and high safety standards.

According to Oliver Wyman (2024), the number of commercial aircraft globally is projected to increase at a compound annual growth rate (CAGR) of 2.5%, reaching over 36,400 aircraft by 2034. This expansion marks a 28% growth from the current global fleet of around 28,400 aircraft. Simultaneously, the global MRO market is anticipated to rebound strongly, with spending expected to hit USD 104 billion in 2024 and rise to USD 124 billion by 2034, albeit with a slower CAGR of 1.8%. These projections highlight the growing importance of efficient and reliable MRO services to support the expanding global aviation fleet and sustain operational readiness.

In this context, the procurement of aircraft parts and engine components emerges as a critical challenge for MRO companies. Efficient procurement processes are essential for ensuring the timely availability of materials required for maintenance activities (Fahriza et al., 2024). Any delays in acquiring parts can severely disrupt operations, resulting in extended aircraft downtimes and higher operational costs. Therefore, developing robust supplier selection frameworks and efficient supply chain strategies is paramount for maintaining service quality and meeting tight maintenance turnaround schedules.

PT XYZ stands as Indonesia's largest and one of Asia Pacific's most prominent MRO providers. With its main hub at Soekarno-Hatta International Airport and operations in over 60 countries, PT XYZ has earned international accreditations from FAA, EASA, and other major authorities. The company's extensive service portfolio includes line maintenance, airframe overhaul, engine and component maintenance, military aviation services, and industrial solutions. Through continuous investments in its facilities, workforce, and strategic initiatives, PT XYZ strives to maintain its reputation as a reliable and innovative MRO player in a highly competitive global market.

Despite its strategic advantages, PT XYZ faces persistent operational challenges, particularly concerning the procurement and supplier management of aircraft painting materials. Delays in procurement have been identified as a major cause for missing Turnaround Time (TAT) targets, which impacts operational efficiency, customer satisfaction, and profitability. Following regulatory changes in late 2024 that shifted supplier selection authority from customers to PT XYZ, the need for an enhanced and structured supplier selection framework became increasingly apparent.

Several previous studies have proposed various methods for supplier selection in the MRO and aerospace industries. For instance, Zhang et al. (2021) applied Fuzzy-TOPSIS for evaluating

supplier risks in aerospace supply chains, while Sari & Wibowo (2022) developed a multi-objective optimization model for spare parts procurement in MRO contexts. However, these approaches often lack a structured prioritization mechanism that integrates expert judgment in a hierarchical decision framework.

Therefore, this study proposes the Analytical Hierarchy Process (AHP) as the methodological approach to develop a comprehensive supplier selection model tailored to PT XYZ's procurement needs. AHP is selected due to its ability to handle both qualitative and quantitative criteria, incorporate expert judgment consistently, and provide a transparent and systematic decision-making process. Compared to other methods, AHP allows for a clear decomposition of complex problems into manageable sub-components, facilitating rational prioritization and weighting of supplier evaluation criteria. By leveraging AHP, this study aims to optimize PT XYZ's procurement strategy, reduce turnaround delays, and support the company's long-term operational objectives.

RESEARCH METHOD

This research adopts a mixed-methods approach, combining qualitative and quantitative strategies to comprehensively address the business issue identified at PT XYZ. The primary objective is to develop a systematic supplier selection framework tailored for aircraft painting projects. Qualitative methods are utilized through semi-structured interviews with key stakeholders directly involved in procurement and maintenance operations, allowing for in-depth exploration of criteria relevant to supplier selection. Meanwhile, quantitative methods are employed via the Analytical Hierarchy Process (AHP) to quantify and prioritize the identified selection criteria systematically. This methodological triangulation ensures that the results are robust, reliable, and reflective of practical realities within PT XYZ's operational context (Kothari, 1990). Both primary data from interviews and questionnaires, and secondary data from historical company records and industry standards, are incorporated to strengthen the research findings. Figure 1 shows Research Framework in this research.

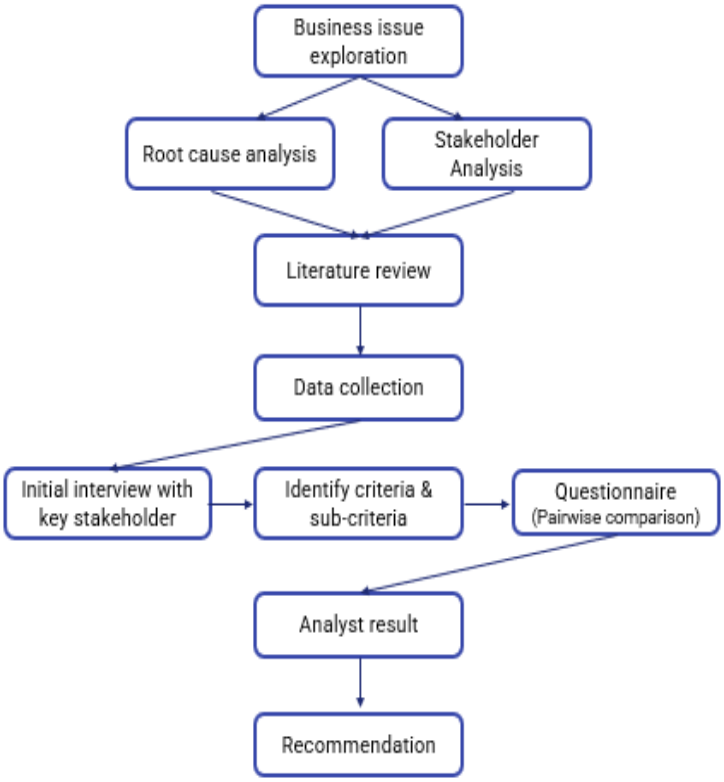

Figure 1. Research framework

The objective of this research is to develop good criteria and factor to determine the awarded supplier for airframe maintenance painting project. The method used on this research is Analytical Hierarchy Process (AHP). AHP is method would support the decision-making process with multiple criteria or parameters in order to define weight of criteria dan sub-criteria. Table 1 shows Stakeholder Analysis.

Table 1: Stakeholder Analysis

	Stakeholder	Definition	Interest	Power
INTERNAL	VP Material Services	They have high interest in sourcing quality materials at competitive prices and ensuring timely delivery.	High	High
	SM Procurement		High	High
	Procurement manager (myself)		High	Moderate
	Production dep (Aircraft Painting)	They have high interest in ensuring a smooth production process, meeting deadlines, and maintaining quality standards	High	Moderate
	Logistic Dep	They have low power to influence transportation routes, carrier selection, and inventory management.	Low	Low
	Quality Dep	Moderate power to influence quality control procedures, inspection standards, and corrective actions	Moderate	Moderate
	Warehousing Dep	High interest in efficient storage, inventory management	Moderate	Low
	Financial Dep	High power to influence financial decisions, budget allocations,	Moderate	High
EXTERNAL	Customer	they want to ensure the TAT maintenance on time so aircraft could operate to generate revenue. They can influence decision through contract	High	High
	Supplier/Manufacturer	their power depends on the availability of the materials and their ability to meet deadlines.	Medium	Moderate
	Custom Clearance (Bea Cukai)	They have the authority to inspect and clear goods, which can impact the project timeline and costs.	Low	High
	Forwarder	They are involved in the logistics and transportation of materials, but their impact on the overall project is less significant.	Low	Low

Data collection is divided into two main sources: primary and secondary. Primary data are collected through interviews and AHP questionnaires involving procurement managers, production leaders, quality assurance personnel, and account managers with significant experience and influence in supplier selection. Interviews are designed to confirm, refine, and prioritize criteria and sub-criteria needed for the supplier selection model. Secondary data are extracted from PT XYZ's Enterprise Resource Planning (ERP) SAP system, historical supplier performance records, internal quality audits, and relevant academic literature (Kothari, 1990; Fahriza et al., 2024). These secondary resources are crucial to validate and complement the qualitative insights gained from interviews, ensuring a comprehensive understanding of both

internal and external supplier performance factors. Data analysis procedures include hierarchical structuring, pairwise comparison matrices, consistency ratio calculations, and priority weight derivations based on the AHP methodology (Saaty & Vargas, 2012). The consistency ration can be calculated by the following steps:

a. Compute λmax of each n matrix by summing the multiplication result between the total weights of all criteria on each matrix column with the main eigenvector value of the matrix.
b. Calculate the consistency index value for each matrix of orde n by using the formula $CI = \frac{\lambda \max - n}{n-1}$
    a. explanation:
    b. CI = Consistency Index
    c. n = orde index
    d. λmax = the largest eigenvector value of the n-coded matrix.
c. The consistency ratio formula could be calculated following below:
    a. $CR = \frac{CI}{RI}$
    b. explanation:
    c. CR = consistency ratio
    d. CI = consistency index
    e. RI = random index for n-coded matrix

The research framework begins with the identification of business issues through stakeholder analysis and root cause analysis, particularly using the 5-Why method to trace procurement inefficiencies. Based on these findings, a hierarchical structure for supplier selection is developed, incorporating criteria such as commercial aspects, quality, delivery, service, strategic partnership, and customer preferences. The AHP method is then applied by conducting pairwise comparisons to determine the relative importance of each criterion and sub-criterion. Aggregation of Individual Priorities (AIP) is used to synthesize stakeholder inputs, ensuring that the final weightings reflect collective judgments rather than isolated opinions (Saaty & Vargas, 2012). Finally, alternatives (potential suppliers) are evaluated against the established criteria framework, and the most suitable supplier is selected based on the highest overall weighted score. This structured methodology offers a transparent, justifiable, and replicable model for future supplier selection processes at PT XYZ. Figure 2 shows Conceptual Framework in this research

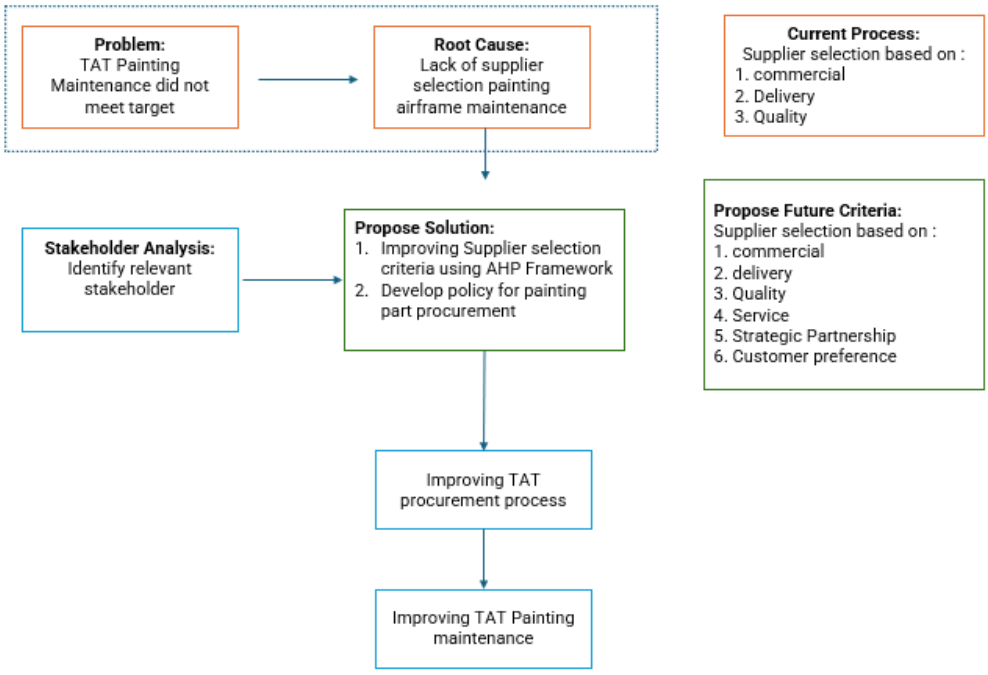

Figure 2. Conceptual Framework

The framework addresses the issue of the Turn Around Time (TAT) for aircraft painting maintenance not meeting the target. It identifies a root cause: challenges in selecting the right suppliers for painting airframe maintenance. In order to identify key stakeholders who need to be interviewed, this research uses stakeholder analysis in supply chain process in the company. Currently, supplier selection is primarily based on commercial factors, quality and delivery (Company Procurement Policy document). But it does not specific mention using AHP framework to determine supplier selection. To address this, the framework proposes two key solutions:

1. Expanding supplier selection criteria beyond commercial, delivery and quality.
2. Developing a formal policy for painting part procurement based on AHP Framework.

RESULTS AND DISCUSSION

Result

The analysis began with the identification and structuring of supplier selection criteria based on interviews with nine stakeholders from procurement, production, quality assurance, and customer-facing units. Through these interviews and literature validation, six primary criteria were identified: commercial aspects, quality, delivery, service, strategic partnership, and customer preference. Each main criterion was further decomposed into specific sub-criteria to capture a more granular assessment of suppliers. For instance, the commercial aspect was detailed into terms of payment, price, discount/rebate program, and incoterms (Setiawan et al., 2022; Fahri et al., 2022). These initial steps ensured that the selection framework would address all relevant dimensions impacting aircraft painting procurement at PT XYZ.

The Analytical Hierarchy Process (AHP) methodology was then applied to prioritize the identified criteria and sub-criteria. Each stakeholder was asked to perform pairwise comparisons between the criteria, using a standardized scale ranging from 1 to 9 to indicate relative importance (Saaty & Vargas, 2012). The pairwise comparison matrices were subsequently aggregated using the Aggregation of Individual Priorities (AIP) method, which considers the weighted influence of stakeholders based on their organizational roles and expertise. Procurement stakeholders, given their direct involvement and responsibility, were assigned higher weights compared to non-procurement stakeholders. This weighting method ensured that the final prioritization was not skewed by less relevant perspectives, thus enhancing the robustness of the model. Figure 3 shows the author defines the following criteria and sub-criteria to be used in the AHP model of supplier selection

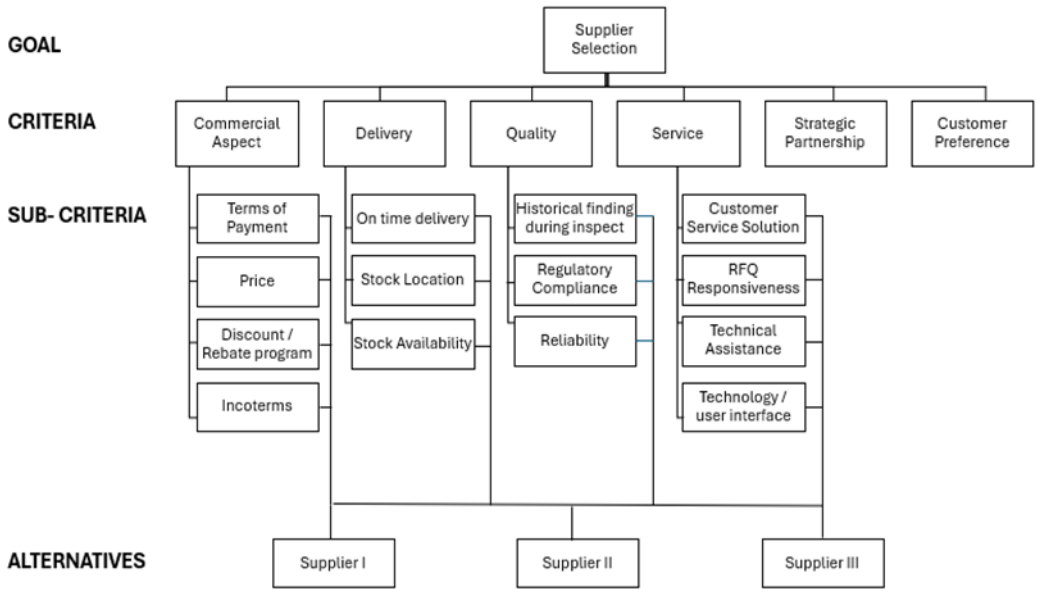

Figure 3. The Selected Supplier Selection Framework

The following explanation below (Table 2).

Table 2: Description of criteria & sub-criteria

Criteria & Sub-Criteria	Description
Commercial Aspect	This criterion focuses on financial and commercial aspects offered by suppliers such as Terms of Payment, Price, Discount/rebate program and incoterms
Terms of Payment (Setiawan et al. 2022)	considers the payment terms offered by the supplier, such as credit periods, payment methods (e.g., cash, credit card, bank transfer)
Price (Fahri et al, 2022)	Consider the price offered and flexibility in price negotiations
Discount / Rebate program (Dey et al, 2010)	This specifically assesses the availability and attractiveness of any discount or rebate programs offered by the supplier
Incoterm (based on interview)	This considers incoterms offered by the supplier
Delivery	This criterion assesses the supplier's ability to deliver materials or services on time and efficiently, such as on-time delivery, stock location & stock availability
On time delivery (Dey et al, 2010)	supplier's ability to deliver materials as per the agreed-upon schedule. Late deliveries can disrupt maintenance operations and lead to costly delays
Stock Location (Fahri et al, 2022)	considers the proximity of the supplier's warehouse or distribution center to the MRO facility. Closer proximity can lead to faster delivery times and reduced transportation costs.
Stock Accuracy	accuracy of the supplier's inventory records. Inaccurate stock information can lead to delays and disruptions in the supply chain
Quality	This criterion evaluates the quality of products or services provided by suppliers such as Regulatory Compliance (Shelf-life, traceability document) Historical MRIR, and Reliability
Historical MRIR Performance (Dey et al, 2010)	Consider the supplier's historical performance based on existing MRIR records (defect parts, deficit parts, traceability parts, etc.)
Regulatory Compliance (Fahri et al, 2022)	Consider aspects of regulatory compliance required by the company such as completeness of documents, document traceability, shelf-life, etc
Reliability (Fahri et al, 2022)	Consider the quality of the material when installed on the aircraft
Service	This criterion assesses the quality of customer service provided by the supplier, including responsiveness to requests and ability to resolve problems
Customer Service Solution (Kahraman et al, 2003)	This assesses the responsiveness and quality of the supplier's customer service, including their ability to address inquiries and resolve issues
RFQ Responsiveness (Kahraman et al, 2003)	This evaluates the supplier's speed and quality of response to requests for quotations (RFQs)

Criteria & Sub-Criteria	Description
Technical Assistance (Based on interview)	Consider technical assistance services such as providing experts, providing training services for mechanics, etc
Technology/ User Interface (Based on interview)	Consider the availability of supplier websites to check material availability status, material status, etc
Strategic Partnership	This evaluates the supplier's commitment to building a long-term relationship with the company.
Customer Preference	This criterion considers customer preferences in selecting suppliers

Measurement model evaluation confirmed that all constructs demonstrated adequate reliability and validity. Cronbach's alpha and composite reliability values exceeded the recommended threshold of 0.70, indicating strong internal consistency across all measurement items. The average variance extracted (AVE) for each construct was greater than 0.50, affirming convergent validity (Hair et al., 2017). Discriminant validity was also established, as the square root of AVE for each construct was higher than the inter-construct correlations. These results support the robustness of the measurement instruments used in assessing work environment, work motivation, employee commitment, and job performance among Generation Z employees. Consequently, the structural model evaluation could proceed with confidence in the measurement model's integrity.

The structural model analysis revealed that workplace environment significantly influenced employee commitment among Generation Z workers ($\beta = 0.356$, $p < 0.001$). This finding corroborates previous studies that emphasize the importance of supportive, flexible, and inclusive environments in fostering commitment among younger employees (Hakim, 2023; Leslie et al., 2021). Elements such as managerial support, flexible scheduling, ethical practices, and a modern physical environment were positively associated with stronger affective and normative commitment among Gen Z employees. These results suggest that Generation Z values a workplace that accommodates both their personal needs and ideals about ethical operations. Consequently, organizations aiming to enhance Gen Z employee commitment must prioritize environmental factors that align with their expectations for flexibility and psychological safety. Figure 3 represents a Second-Order Model, where the second-stage evaluation focuses on the second-level construct, which is a latent variable. The second-order construct is formed using first-order factor scores (dimensions) that have undergone the SEM-PLS evaluation process and were extracted in the first stage.

Consistency ratios (CR) were calculated for each stakeholder's responses to ensure logical consistency in their pairwise judgments. According to Saaty's guideline, a CR below 0.10 is considered acceptable (Saaty & Vargas, 2012). All stakeholders achieved CR values between 0.03% and 2.5%, indicating highly consistent judgments across the board. Consistency validation is critical in AHP to avoid random or contradictory preferences that could undermine the decision-making framework. The overall consistency further validated the reliability of the criteria weights derived from the stakeholders' assessments.

The aggregated results revealed that quality emerged as the most critical criterion, followed closely by commercial aspects and delivery. Within the quality dimension, regulatory compliance (e.g., document traceability, shelf-life, adherence to aviation standards) was identified as the top sub-criterion with a global priority weight of 0.15, equal to the weight assigned to price under commercial aspects. Reliability of material performance ranked third, further emphasizing the technical rigor required in aviation MRO operations (Fahri et al., 2022). These findings highlight PT XYZ's strategic emphasis on maintaining airworthiness and regulatory compliance through its supplier partnerships. Table 3 shows combination of all respondent result.

Table 3: Combination of all respondent result

Level 1 Criteria	Local Weight	Level 2 Sub-criteria	Local Weight	Level 3: Global Priorities (Result)
Commercial Aspect	0.26	Terms of Payment	0.21	0.05
		Price	0.56	0.15
		Discount / Rebate program	0.14	0.04
		Incoterms	0.08	0.02
Quality	0.30	Historical Finding inspection	0.10	0.03
		Regulatory Compliance	0.51	0.15
		Reliability	0.39	0.11
Delivery	0.15	On time delivery	0.42	0.06
		Stock Location	0.18	0.03
		Stock Availability	0.40	0.06
Service	0.11	Customer Service Solution	0.36	0.04
		RFQ responsiveness	0.21	0.02
		Technical Assistance	0.27	0.03
		Technology/ User Interface	0.16	0.02
Strategic Partnership	0.09			0.09
Customer Preference	0.09			0.09

Conversely, service aspects and strategic partnership criteria received relatively lower weights compared to quality, commercial, and delivery aspects. Among the service sub-criteria, customer service solutions and technical assistance were considered moderately important, while responsiveness to requests for quotations (RFQs) and the presence of user-friendly digital interfaces were ranked lowest. This result suggests that while service quality remains relevant, it is not the primary concern when selecting suppliers for critical aircraft maintenance materials. The relatively low prioritization of technological user interfaces likely reflects the specific nature of aircraft painting procurement, where customized orders dominate over standardized catalog transactions.

The next phase of the analysis involved evaluating three potential suppliers, anonymized as Supplier I, Supplier II, and Supplier III, against the weighted criteria. Quantitative ratings were assigned to each supplier based on secondary data analysis, including past performance records, quality inspection findings, delivery punctuality, and compliance documentation. For qualitative aspects, stakeholder assessments during interviews were synthesized to form rating inputs. Each supplier's score for every sub-criterion was multiplied by the respective global priority weight, and then summed to generate the final composite score.

Supplier II achieved the highest composite score among the three alternatives, driven by its excellent reliability, the lowest MRIR (2.41%), strong customer service, and consistent on-time delivery with 1–2 weeks stock availability. Additionally, it demonstrated solid customer feedback and competitive pricing, though it adopted a less aggressive pricing stance compared to Supplier I. Supplier I, while offering the most competitive commercial terms and favorable customer ratings, was limited by the highest MRIR rate (19.85%), weak customer service responsiveness, and delayed delivery due to longer stock lead times. Supplier III, despite its strengths in eco-friendly formulations, dependable delivery, and past collaboration with the

company, was rated lower overall due to premium pricing and average results in compliance and user satisfaction. Table 4 presents the detailed comparison of supplier performance.

Table 4: Supplier performance comparison

Criteria	Supplier I	Supplier II	Supplier III
Commercial Aspect	Offers the most competitive price and decent rebate program	Offers moderate pricing and average rebate, though less competitive than Supplier I	Highest pricing but provides the most generous rebate
Quality	Regulatory compliance but has the highest historical MRIR issue (19.85%) among all	Very good reliability and the lowest MRIR (2.41%) with full compliance	Good compliance and reliability with MRIR slightly higher than Supplier II (3.41%)
Delivery	Delivery often delayed with stock located in Singapore and 2–4 weeks availability	Excellent performance with consistent, on-time delivery and 1–2 weeks stock availability from Germany	Reliable and timely delivery from the Netherlands with 2–4 weeks availability
Service	Customer service is poor with weak responsiveness and limited technical support	Strong technical and RFQ responsiveness, supported by good customer service	Service performance is strong with excellent technical assistance
Strategic Partnership	No historical collaboration, but currently in contract progress	No prior partnership and no ongoing contract progress	Has a historical agreement with company, though no current contract progress
Customer Preference	Generally preferred by customers with a good rating	Rated very good by customer feedback	Customer rating is good, similar to Supplier I

A detailed breakdown of the scoring showed Supplier I demonstrates strong performance in several commercial aspects. they offer the most competitive pricing and a decent rebate program. Customer preference is positive but not outstanding. Supplier II emerges as the most well-rounded performer, excelling in both quality and service-related sub-criteria. They also have better delivery in sub-criteria lead time compared others. Supplier III shows strengths in rebate programs. They also provide better technical assistance compared to other suppliers. These granular insights are vital for justifying supplier selection decisions within PT XYZ's governance frameworks. Table 5 shows Final Results of Composite Evaluation.

Table 5: Final results of composite evaluation

Supplier	General Description	Result
Supplier I	Superior performance in pricing and discount/ rebate program in commercial aspect.	Lowest Score
Supplier II	The most well-rounded performer, excelling in both quality and service-related sub-criteria. Offering moderate pricing and average rebate	**Highest Score**
Supplier III	shows particular strengths in rebate programs. provide better in technical assistance compare to other suppliers	Intermediate Score

Implementation Plan

The findings also provided strategic insights into existing gaps in PT XYZ's procurement processes. For instance, suppliers' inconsistencies in delivery timing and documentation quality were found to directly correlate with delays in aircraft painting turnaround times (TAT). Moreover, the research revealed that relying solely on commercial aspects without systematically considering quality and delivery risks could expose PT XYZ to operational inefficiencies and compliance penalties. This outcome reinforced the need for multi-criteria evaluation frameworks such as AHP, particularly for aviation MRO procurement where regulatory rigor and technical performance are non-negotiable (Paidamoyo Madondo & Manzini, 2020).

A root cause analysis, conducted earlier in the research, identified gaps in knowledge among purchasing personnel, inadequate supplier criteria, and weak material data quality management as key contributors to procurement inefficiencies. The final AHP results corroborated these findings, particularly emphasizing that enhancing supplier evaluation criteria could significantly mitigate material availability issues. By adopting the new criteria framework, PT XYZ can better anticipate potential risks associated with supplier performance and ensure greater material readiness for aircraft painting projects.

Furthermore, stakeholder feedback collected during validation sessions highlighted a strong endorsement for institutionalizing the AHP-based supplier evaluation model within PT XYZ's standard operating procedures. Several participants emphasized that the structured criteria not only enhanced decision-making transparency but also facilitated better accountability among procurement teams. The flexibility of the AHP model to incorporate future changes in operational priorities such as environmental sustainability or technological innovation was also noted as a critical advantage for long-term organizational adaptability. Below will be the implementation plan both for internal & external stakeholder (Table 6):

Table 6: Implementation plan

Activity	PIC	Timeline
Closing Tender		
awarding process to selected supplier	procurement team	May
notification to all alternative supplier	procurement team	May
Procurement process		
submit PO to supplier	procurement team	May
confirm payment	procurement team, finance team	May
material preparation as propose lead time	supplier	May-June
material shipment	supplier	June
custom clearance process	supplier	June
Inspection process	Quality team	June
Training preparation for painting aircraft		June
Material Installation		
on-site technical assistance staff deployment	supplier, production team	July-Dec
Painting process	supplier, production team	July-Dec
Redesign Policy & Procedure of Procurement		
Propose policy & procedure of procurement to add several criteria	procurement team, business process team	May
Risk assessment	procurement team, finance team	May
Review and analysis with business process unit	procurement team, business process team	May-July

Activity	PIC	Timeline
Approval from management	procurement team, business process team	July
Change Parameter in ERP Procurement		
Identify the change requirement, including cost & benefit analysis and risk assessment	Procurement team, IT team, finance team	May-July
Approval budget	Board of Management	July
Development and configuration	Procurement team, IT team	Aug-Nov
User Acceptance Testing	Procurement team, IT team	Oct-Nov
User Training	Procurement team, IT team	Nov
Go-live	Procurement team, IT team	Dec

Discussion

The results of this study emphasize the critical role of structured supplier selection processes in ensuring operational excellence within the aviation MRO sector. Specifically, the research highlights that relying solely on commercial factors as was previously practiced at PT XYZ is no longer sufficient to meet the increasing demands for operational efficiency and customer satisfaction. The findings confirm that quality-related factors, particularly regulatory compliance and material reliability, must be prioritized, as deficiencies in these areas can lead crucial role in supply chain efficiency (Fahriza et al., 2024). This aligns with prior studies in both aviation and manufacturing contexts, such as those by Tahriri et al. (2008) and Görener et al. (2017), who emphasized the importance of multi-criteria evaluation models in complex procurement environments.

Moreover, the results support the argument made by Kahraman et al. (2003) and Chan & Kumar (2007), who found that supplier evaluation models that balance technical and commercial criteria tend to yield more resilient procurement outcomes. What distinguishes this study is its focus on the specific context of aircraft painting material procurement an area often overlooked in mainstream MRO procurement literature, which generally emphasizes engine parts or structural components. Additionally, while prior works such as Rouyendegh (2012) and Ho et al. (2010) applied AHP and other MCDM methods in general industrial procurement or defense-related supply chains, this study is among the first to apply AHP specifically within the Indonesian MRO sector and propose its integration into an Enterprise Resource Planning (ERP) system.

The implementation of the Analytical Hierarchy Process (AHP) in this study offered a structured, transparent, and consistent method for evaluating suppliers across six main and fourteen sub-criteria. The model's hierarchical design enabled decision-makers to simultaneously assess quality, cost, service, delivery, and compliance dimensions mirroring the multi-faceted nature of MRO procurement. The consistently high consistency ratios across judgment matrices further validate the methodological soundness and stakeholder alignment. Unlike simpler scoring methods or intuition-based selection, AHP provides analytical rigor, especially useful in industries where safety and compliance are non-negotiable (Saaty & Vargas, 2012). This approach is in line with findings from Li et al. (2018), who applied AHP in aerospace logistics and confirmed its reliability in prioritizing conflicting decision factors.

A key novelty of this study lies in its proposal to embed the AHP-based decision framework into PT XYZ's ERP system a step that has not been explicitly documented in existing Indonesian aviation literature. While global studies by Bayo-Moriones et al. (2013) and Arif-Uz-Zaman & Ahsan (2014) discussed the benefits of digital integration in procurement, there is limited evidence of an AHP model being formally institutionalized into an MRO ERP workflow within the Southeast Asian or Indonesian context. This integration represents a significant advancement, potentially serving as a model for other MRO providers seeking data-driven and adaptive procurement systems.

Furthermore, this study underscores the importance of ongoing supplier performance evaluation, moving beyond initial selection toward continuous monitoring. This is consistent with supplier relationship management (SRM) theories (Choy et al., 2004) that stress the long-term value of collaboration and performance feedback. As observed by Asmara & Kusumah (2021), such continuous evaluation enhances not only operational effectiveness but also builds supplier trust and responsiveness. Thus, PT XYZ is encouraged to establish a performance review mechanism aligned with the AHP framework to ensure alignment with evolving quality, regulatory, and delivery expectations.

While service performance and technological responsiveness were found to be of lower relative weight in this study, these criteria should not be underestimated. In a digitally transforming industry, supplier interface usability and speed in responding to RFQs could become decisive, especially in time-critical maintenance operations. This insight supports Javad et al. (2020), who emphasized the growing relevance of procurement digitalization and innovation capabilities in supplier performance. Future iterations of the model could expand to include these technological enablers as explicit sub-criteria.

Another important insight involves the moderate importance of customer preference in the evaluation process. While compliance and operational efficiency remain dominant, incorporating customer input into procurement decisions may enhance long-term client satisfaction and loyalty particularly relevant for MRO providers serving multiple airline clients. This finding echoes Madondo & Manzini (2020), who argued that aligning supplier capabilities with customer service requirements strengthens strategic relationships in service-intensive industries.

Despite its strengths, this study is bound by its focus on aircraft painting materials. Broader application across other MRO categories such as avionics, engine modules, and structural repairs would provide a more holistic validation of the AHP framework. Additionally, a comparative analysis involving other MCDM methods such as TOPSIS (Triantaphyllou, 2000), PROMETHEE (Behzadian et al., 2010), or fuzzy-AHP variants could enrich model robustness and contextual adaptability. Integrating sensitivity analysis could also help decision-makers test how supplier rankings shift under different operational conditions, supporting more agile procurement planning.

In conclusion, this research contributes both theoretically and practically by introducing a replicable AHP-based model for supplier selection in aviation MRO, uniquely proposing its integration into an ERP system within an Indonesian context. The model strengthens strategic procurement decisions, supports regulatory and customer alignment, and enhances PT XYZ's readiness in a dynamic and safety-critical industry.

CONCLUSION

This research concludes that the application of the Analytical Hierarchy Process (AHP) within a Multi-Criteria Decision-Making (MCDM) framework is effective in structuring supplier selection for airframe maintenance materials in the aviation Maintenance, Repair, and Overhaul (MRO) industry. Six primary criteria were established Commercial Aspects, Quality, Delivery, Service, Strategic Partnership, and Customer Preference supported by fourteen operational sub-criteria. These include payment terms, pricing, regulatory compliance, on-time delivery, stock availability, technical support, and user interface quality.

The active involvement of key internal stakeholders in defining and weighting these criteria enhanced the model's contextual relevance and acceptance. The results show that quality, particularly regulatory compliance and reliability, is the most critical factor in supplier selection, followed closely by price competitiveness. This underscores the importance of balancing operational excellence with cost-efficiency in a safety-critical and highly regulated environment like aircraft maintenance.

The main advantages of this study lie in its ability to deliver a transparent, systematic, and replicable model that can improve consistency and objectivity in supplier selection decisions.

Furthermore, it provides actionable insights by identifying and ranking criteria that truly reflect the strategic needs of PT XYZ.

However, this study has certain limitations. It focuses solely on aircraft painting materials and one MRO provider, which may limit its generalizability across other materials or sectors. Additionally, the model currently depends on manual stakeholder input, which could be optimized through greater automation. To maximize the benefits of this research, several strategic recommendations are proposed:

1. Redesign procurement policies and procedures to formally integrate the AHP framework as a standard supplier evaluation tool. This should include clear criteria definitions, scoring guidelines, documentation protocols, and training programs to ensure consistent application across procurement teams.
2. Integrate the AHP scoring system into the company's ERP or e-procurement platform to enhance automation, efficiency, traceability, and compliance with auditing requirements.
3. Review and recalibrate the AHP criteria and weightings regularly, ideally on an annual or semi-annual basis, to reflect evolving strategic goals, market conditions, and regulatory changes. Stakeholder engagement through surveys or focus groups will ensure continued relevance and agility.

While the current AHP framework is stable in terms of structure, the global weights should be updated periodically through renewed stakeholder input using pairwise comparison questionnaires to ensure alignment with the company's operational dynamics. Potential applications of this model extend beyond aircraft painting materials. It can be adapted for other critical procurement areas such as engine components, tooling, logistics services, and capital projects (e.g., hangar development), offering scalability and flexibility for broader supply chain management needs.

In summary, this study offers not only a practical decision-making tool for aviation procurement but also contributes to the broader body of knowledge in supply chain and procurement management by demonstrating the successful integration of AHP into an MRO ERP system an approach not previously documented in the Indonesian context.

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