

Utilization Of The AHP Method As A Decision-Making Tool For Polybag Supplier Selection At PT X

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Abstract

The issue of managing supplier performance presents a significant challenge in the smooth functioning of a company's supply chain, particularly in the manufacturing industry. The challenges faced include delays in raw material deliveries, discrepancies in the quantity received versus the order, and product quality not meeting the specified standards. These problems have the potential to disrupt production processes and the operational efficiency of the company. At PT X, these issues specifically occur with the polybag supplier. Therefore, a study will be conducted to address this problem. This research uses the Analytical Hierarchy Process (AHP) method as a decision-making tool to determine the priority of polybag suppliers based on several criteria discussed with expert respondents. The AHP method is chosen for its ability to break down complex issues into a hierarchical structure and assign weights to each criterion based on pairwise comparisons. The AHP analysis results show that the timeliness of delivery is the highest priority factor, with a weight of 0.462, surpassing cost, quality, and service. Based on the global priority weight calculation, PT Bintang is established as the best polybag supplier with the highest score (0.460), followed by PT Plastik (0.306) and PT Nusa (0.233). Therefore, PT Bintang is recommended as the primary choice to ensure the smooth operation of the company.

Keywords: Supplier Selection, AHP, Decision Making.

INTRODUCTION

The automotive manufacturing industry is currently experiencing rapid growth, bringing various benefits and challenges, particularly for companies producing plastic-based automotive components. In response to increasingly intense competition, automotive manufacturing companies are required to continuously innovate to achieve a competitive advantage. One important aspect that must be considered is the procurement

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system for high-quality raw materials. The procurement department plays a crucial role in supplier selection and performance evaluation as part of efforts to maintain quality and supply chain efficiency. As explained by Arya et al. (2018), selecting the appropriate supplier can reduce purchasing costs and enhance a company's competitiveness, making it a key factor in supporting overall organizational performance.

PT X, located in Cikarang, is a company operating in the automotive industry, particularly in the production of plastic-based components for two-wheeled vehicles. In its production process, the company primarily uses plastic pellets as raw materials and also requires polybags as packaging materials to maintain the quality of its finished products. This requirement necessitates collaboration with external suppliers. Currently, PT X has established partnerships with three suppliers, namely PT Plastik, PT Bintang, and PT Nusa. However, each supplier demonstrates different levels of performance, particularly in terms of service and product quality. PT X frequently encounters issues related to the performance of its polybag suppliers, including delivery delays of one to three days and discrepancies between the quantities delivered and those ordered. These problems frequently occur with PT Plastik and affect the company's productivity and its ability to maintain the quality of finished products. Similar issues were reported by Noviani et al. (2021), who found that PT X experienced problems related to deliveries that did not meet the agreed schedule and the receipt of defective raw materials supplied by vendors.

According to Huwaida (2018), the quality of raw materials is an important criterion that must be maintained to support the timely fulfillment of customers' production demands. Therefore, raw material quality standards are also a major consideration for PT X in maintaining the quality of products delivered to customers. One aspect that requires particular attention is the quality of product packaging, which is regulated by company policies concerning the required thickness and dimensions of the packaging. However, PT X has experienced packaging quality problems caused by suppliers, such as polybags that tear easily due to thickness and dimensional specifications that do not conform to the company's requirements. In addition, PT X has not yet identified a primary supplier that can be consistently relied upon or established alternative suppliers as backup options. The supplier performance evaluation and decision-making processes are therefore complex and involve considerable risks, as each supplier has distinct strengths and weaknesses. Inaccurate supplier performance assessments may result in operational inefficiencies and potential losses for the company.

This study employs a quantitative approach to determine the weights of the criteria used in selecting the best supplier. The criteria weights are determined through questionnaires distributed to expert respondents, including the purchasing manager, the head of the purchasing department, and staff members directly involved in the purchasing



process. Several important elements in this process include the identification of criteria, subcriteria, and supplier alternatives.

To facilitate and improve the objectivity of the evaluation process, PT X requires a decision-making method capable of supporting the systematic and measurable selection of the best supplier. Therefore, this study applies the Analytical Hierarchy Process (AHP) method. AHP is a decision-making method used to determine priorities among a number of alternatives, particularly when multiple criteria must be considered. This method enables decision-makers to structure complex problems into an integrated hierarchical framework, which generally consists of three levels: objectives, criteria, and alternatives (Himawan, 2022).

Based on the background described above, this study aims to identify the criteria and subcriteria used to select the best polybag supplier for PT X, determine the priorities and weights of each criterion using the AHP method, and identify the most suitable polybag supplier in accordance with PT X's standards and operational requirements.

Literature Review

Supply Chain Management (SCM)

A company seeking to enhance its competitiveness through product customization, high-quality standards, cost reduction, and rapid distribution must pay close attention to its supply chain. The supply chain encompasses all stages directly or indirectly involved in fulfilling customer demand, including manufacturers, suppliers, carriers, warehouses, retailers, and end consumers (Pulansari et al., 2023). Supply chain management refers to the integrated management of information, goods, and services involving all parties throughout the entire supply chain, from suppliers and distributors to retailers, stores, and consumers. By implementing effective supply chain management, industries can better manage potential losses and benefits, thereby improving the efficiency and effectiveness of production processes and the distribution of goods and services (Jamaludin, 2022).

Supplier

Suppliers are business partners responsible for ensuring the availability of raw materials. Therefore, a company's performance partly depends on the suppliers' ability to deliver the required materials accurately and on time (Ramadhan, 2022). In conducting business activities, companies require appropriate partners to establish effective and sustainable collaboration. One of the most important business partners is the supplier. Within supply chain management, suppliers play a critical role in meeting the raw material requirements of manufacturing companies and supporting the continuity of their production processes (Lestari et al., 2023).



Supplier Performance Evaluation

Supplier performance evaluation is an essential activity in supply chain management that influences the accuracy and effectiveness of supplier selection decisions (Pitaloka et al., 2022). Supplier selection should be based on relevant criteria involving decision-makers, with decisions derived from assessments of suppliers' actual performance and operational conditions. According to Pujotomo et al. (2016), supplier selection involves several criteria and subcriteria. The Quality criterion includes quality-related certifications, packaging accuracy, and conformity to quality specifications. The Cost criterion includes raw material prices and discounts. The Delivery criterion consists of lead time, flexibility, on-time delivery, delivery quantity accuracy, and geographical location. The Service criterion includes warranties and claim policies, procedural compliance, responsiveness, communication systems, and payment-term flexibility. Finally, the Green Supplier criterion includes green processes and internal control processes.

Procurement of Goods and Services

The procurement of goods and services was initially conducted through direct cash transactions in traditional markets. Over time, these activities developed into purchasing systems involving deferred payment arrangements and the preparation of accountability documents between buyers and sellers. Subsequently, procurement evolved into more structured purchasing and tendering systems (Diva et al., 2024).

The procurement procedure for goods and services consists of several stages. The process begins with an analysis of the company's needs to identify the required goods or services. This is followed by managerial approval before purchasing activities are undertaken to prevent potential adverse effects on the company's financial performance. The company then conducts a supplier analysis to assess suppliers' ability to meet organizational requirements accurately, efficiently, and sustainably. The subsequent stages include conducting a tender process to identify suppliers offering the most favorable combination of price and quality, requesting quotations from suppliers that meet the established criteria, and conducting negotiations and supplier selection based on the proposed prices and delivery schedules.

After a supplier has been selected, the procurement team prepares a purchase order or a legally binding cooperation agreement to clarify the responsibilities of both parties. The next stage involves receiving the goods and conducting quality inspections to ensure compliance with the agreed specifications and established quality standards. The final stage is payment for the goods and services received after confirming that the invoice corresponds to the actual condition and quantity of the goods or services delivered.



Research Methodology

This study was conducted at PT Mada Wikri Tunggal – Plant 3, located at Jl. Raya Industri, Pasirgombong, North Cikarang District, Bekasi Regency, West Java 17530, Indonesia, from July 2024 to February 2025. The study aimed to identify the best polybag supplier for PT X by evaluating several issues encountered in the procurement process, including delivery delays, discrepancies between the quantities delivered and those requested, and polybag quality that did not meet the company's established standards. Therefore, this study employed a quantitative approach based on the positivist paradigm. This approach involves collecting data through research instruments and subsequently analyzing the data using quantitative or statistical methods.

Primary data were obtained directly from the research site through several data collection methods, including Focus Group Discussions (FGDs), interviews, and questionnaires. The FGDs were conducted between the researchers and expert respondents from relevant divisions at PT X to identify and discuss the criteria and subcriteria used to select the best polybag supplier. The selection of these criteria was based on practical experience in the field, their impact on the production process, and their relevance to the automotive industry.

Data were also collected through structured questionnaires distributed to expert respondents involved in the polybag procurement process. The questionnaires employed a pairwise comparison method in accordance with the principles of the Analytical Hierarchy Process (AHP). This approach was used to calculate the priority weights of the identified criteria and to assess the consistency of the respondents' judgments in selecting the most suitable polybag supplier.

Table 1. Criteria and Subcriteria Identified Through the Focus Group Discussion (FGD)

No.	Criteria	Description	Subcriteria
1	Product Quality	Product quality refers to the characteristics of a product or service that enable it to meet customer requirements.	• Specification Conformity: The degree to which a product complies with the established specifications. • Defect Rate: The percentage of defective products relative to the total number of products produced. • Quality Consistency: The ability to maintain stable product quality over time.
2	Delivery Reliability	Delivery reliability refers to the supplier's ability to deliver	• On-Time Delivery: The ability to deliver goods according to the

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		goods on time and in accordance with the agreed quantity.	agreed schedule. • Quantity Accuracy: The extent to which the delivered quantity corresponds to the ordered quantity. • Delivery Consistency: The ability to consistently maintain delivery timeliness and quantity accuracy over repeated transactions.
3	Cost	Cost refers to the total expenditure incurred by the company to obtain goods or services from a supplier.	• Price Consistency: The stability of supplier prices without unfavorable fluctuations. • Discounts: Price reductions or incentives provided by the supplier. • Negotiation Flexibility: The supplier's willingness and flexibility to reach mutually beneficial pricing agreements.
4	Service	Service refers to the support or assistance provided by suppliers to fulfill customer needs and enhance customer satisfaction.	• Responsiveness: The supplier's ability to respond promptly to requests or changes. • Complaint Handling: The supplier's ability to resolve problems or nonconformities quickly and appropriately. • Effective Communication: The clear, accurate, and easily understandable exchange of information between the supplier and the company.

Source: Data Processing, 2025.

The population of this study comprised all employees of PT X who were directly involved in the purchasing, procurement, and management of polybag suppliers. The research sample was selected from this population to obtain accurate and relevant data regarding the selection of the best polybag supplier. The sample consisted of personnel from the Purchasing Department and staff involved in the polybag procurement process,

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including: Respondent 1, a Purchasing Manager with two years of work experience, who served in a supervisory role and possessed an overall understanding of purchasing activities; Respondent 2, the Head of the Purchasing Department with 20 years of work experience, who was responsible for making decisions regarding supplier selection; and Respondent 3, a Production Planning and Inventory Control (PPIC) staff member with three years of work experience, who was directly involved in the operational management of raw materials.

The data collected in this study were subsequently analyzed using the Analytical Hierarchy Process (AHP) method. The problem hierarchy was structured into four levels: Level 0 represented the overall objective, Level 1 consisted of the criteria used to evaluate suppliers, Level 2 included the subcriteria associated with each criterion, and Level 3 represented the alternative suppliers considered in the decision-making process. A pairwise comparison matrix was used to assess the relative importance of the elements within each group of criteria and alternatives. Subsequently, the priority weights for each criterion were calculated using the eigenvector method, producing decimal values that represented the relative importance of each criterion.

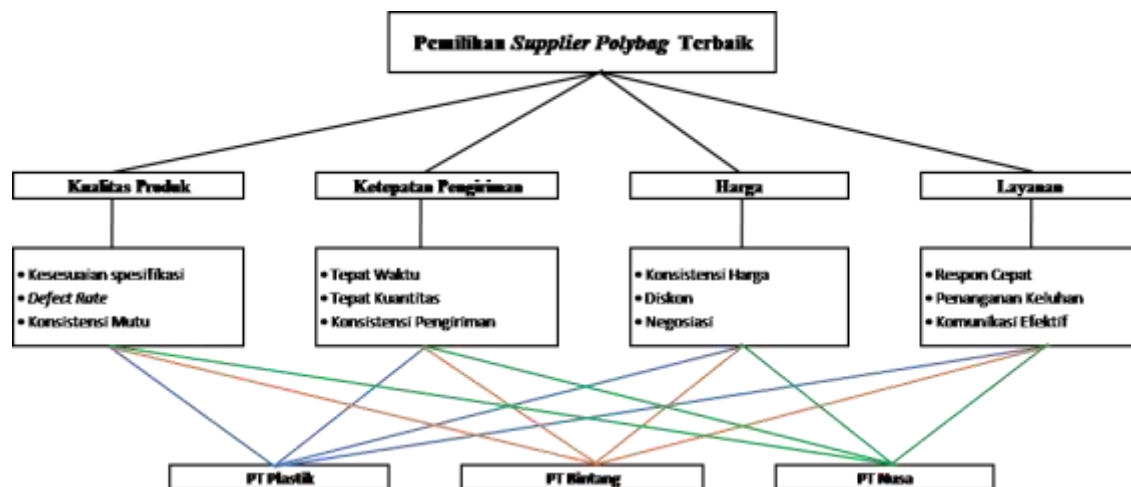
Consistency testing was conducted by calculating the Consistency Index (CI) and Consistency Ratio (CR) to ensure that the pairwise comparisons among the elements were logically consistent. The final stage of the analysis involved calculating the global priorities by multiplying the priority weights of the supplier alternatives by the corresponding priority weights of the criteria. This process produced the final ranking and supported the identification of the most suitable supplier.

DISCUSSION

Development of the Problem Hierarchy Structure

The initial stage of data processing in this study involved defining the research problem as the primary objective (goal), identifying as many relevant criteria as possible, and determining the available decision alternatives. In this study, the hierarchical structure was developed across four levels. Level 0 represented the main objective, Level 1 consisted of the supplier evaluation criteria, including product quality, delivery reliability, cost, and service, Level 2 comprised the subcriteria associated with each criterion, and Level 3 represented the supplier alternatives, namely PT Plastik, PT Bintang, and PT Nusa. The hierarchical structure developed in this study is presented in Figure 1.



**Figure 1. Research Hierarchy Structure***Source: Data Processing, 2025.***Overall Consistency Ratio (CR) of the Hierarchy**

After the research data were analyzed using the Analytical Hierarchy Process (AHP) method, the Consistency Ratio (CR) values for the criteria, subcriteria, and alternatives were found to be below 0.10. This indicates that the pairwise comparison judgments were consistent and that the results of the analysis were considered acceptable and valid. The overall Consistency Ratio results for the hierarchical structure are presented as follows:

Table 2. Overall Consistency Ratio (CR) of the Hierarchy

Hierarchy	CR	Result
Criteria Comparison	0.099	VALID
Quality Subcriteria Comparison	0.071	VALID
Delivery Reliability Subcriteria Comparison	0.041	VALID
Cost Subcriteria Comparison	0.079	VALID
Service Subcriteria Comparison	0.074	VALID
Alternative Comparison for Specification Conformity	0.028	VALID
Alternative Comparison for Defect Rate	0.075	VALID
Alternative Comparison for Quality Consistency	0.065	VALID
Alternative Comparison for On-Time Delivery	0.084	VALID
Alternative Comparison for Quantity Accuracy	0.065	VALID
Alternative Comparison for Delivery Consistency	0.040	VALID
Alternative Comparison for Price Consistency	0.004	VALID
Alternative Comparison for Discounts	0.065	VALID
Alternative Comparison for Negotiation Flexibility	0.084	VALID
Alternative Comparison for Responsiveness	0.083	VALID

Alternative Comparison for Complaint Handling	0.077	VALID
Alternative Comparison for Effective Communication	0.077	VALID

Source: Data Processing, 2025.

Based on Table 5.1, the overall results of the hierarchical structure were considered acceptable and valid. Therefore, the calculated results can be used to support the decision-making process for selecting the best polybag supplier at PT X.

Global Priority Weights

To determine the final results and support the decision-making stage in a study using the Analytical Hierarchy Process (AHP), global priority weights must be calculated. These weights are obtained by multiplying the priority weights assigned to the relevant criteria, subcriteria, and supplier alternatives included in the analysis. The results of the global priority weight calculations are presented as follows:

Table 3. Global Priority Weights

Level 0 (Goal)	Level 1 (Criteria)	Criteria Weight	Level 2 (Subcriteria)	Subcriteria Weight	Level 3 (Alternatives)	Alternative Weight	Global Priority
Selection of the Best Polybag Supplier at PT X	Product Quality	0.226	Specification Conformity	0.150	PT Plastik	0.159	0.0054
					PT Bintang	0.730	0.0247
					PT Nusa	0.111	0.0038
			Defect Rate	0.088	PT Plastik	0.173	0.0034
					PT Bintang	0.691	0.0137
					PT Nusa	0.136	0.0027
	Delivery Reliability	0.462	Quality Consistency	0.760	PT Plastik	0.619	0.1063
					PT Bintang	0.278	0.0477
					PT Nusa	0.104	0.0179
			On-Time Delivery	0.144	PT Plastik	0.240	0.0160
					PT Bintang	0.544	0.0362
					PT Nusa	0.215	0.0143
			Quantity Accuracy	0.093	PT Plastik	0.108	0.0046

					PT Bintang	0.646	0.0278
					PT Nusa	0.246	0.0106
			Delivery Consistency	0.763	PT Plastik	0.110	0.0388
					PT Bintang	0.627	0.2210
					PT Nusa	0.264	0.0931
	Cost	0.245	Price Consistency	0.185	PT Plastik	0.132	0.0060
					PT Bintang	0.499	0.0226
					PT Nusa	0.369	0.0167
			Discounts	0.507	PT Plastik	0.646	0.0802
					PT Bintang	0.108	0.0134
					PT Nusa	0.246	0.0306
			Negotiation Flexibility	0.308	PT Plastik	0.633	0.0478
					PT Bintang	0.115	0.0087
					PT Nusa	0.252	0.0190
	Service	0.067	Responsiveness	0.243	PT Plastik	0.279	0.0045
					PT Bintang	0.575	0.0094
					PT Nusa	0.146	0.0024
			Complaint Handling	0.392	PT Plastik	0.288	0.0076
					PT Bintang	0.110	0.0029
					PT Nusa	0.601	0.0158
			Effective Communication	0.365	PT Plastik	0.288	0.0070
					PT Bintang	0.601	0.0147
					PT Nusa	0.110	0.0027

Source: Data Processing, 2025.

The priority weights of the criteria in this study, as presented in Table 5.2, indicate that Delivery Reliability received the highest weight (0.462), followed by Cost (0.245), Product Quality (0.226), and Service, which received the lowest weight (0.067).

Decision-Making (Determination of Overall Weights)

After obtaining the global priority weights for all elements included in the AHP analysis, the next step was to calculate the overall priority score for each supplier



alternative by summing its global priority values across all relevant criteria and subcriteria. The calculation results are presented as follows:

Table 4. Determination of the Overall Weights of Each Supplier Alternative

Criteria	Subcriteria	PT Bintang	PT Plastik	PT Nusa
Product Quality	Specification Conformity	0.730	0.159	0.111
	Defect Rate	0.691	0.173	0.136
	Quality Consistency	0.278	0.619	0.104
Delivery Reliability	On-Time Delivery	0.544	0.240	0.215
	Quantity Accuracy	0.646	0.108	0.246
	Delivery Consistency	0.627	0.110	0.264
Cost	Price Consistency	0.499	0.132	0.369
	Discounts	0.108	0.646	0.246
	Negotiation Flexibility	0.115	0.633	0.252
Service	Responsiveness	0.575	0.279	0.146
	Complaint Handling	0.110	0.288	0.601
	Effective Communication	0.601	0.288	0.110
Total Overall Weight		0.460	0.306	0.233
Rank		1	2	3

Source: Data Processing, 2025.

Based on Table 5.3, the final results of the study indicate that PT Bintang was identified as the best supplier alternative, achieving the highest overall score of 0.460. PT Plastik ranked second with a score of 0.306, while PT Nusa ranked third with the lowest score of 0.233.

Based on the results of the data processing and analysis, this study produced two main considerations for the selection of the best polybag supplier. The first concerns the priority ranking of the evaluation criteria, in which Delivery Reliability received the highest weight (0.462), followed by Cost (0.245), Product Quality (0.226), and Service, which received the lowest weight (0.067). The second concerns the priority ranking of the supplier alternatives, which identified PT Bintang as the best alternative, with the highest overall score (0.460), followed by PT Plastik (0.306), while PT Nusa ranked last (0.233).

Based on the results of the AHP analysis, PT Bintang was ranked first and selected as the primary polybag supplier. This selection is expected to support the continuity and smooth operation of the production process, as PT Bintang was considered capable of

minimizing delivery delays, ensuring that the quantities received correspond to the quantities ordered, and providing products that meet the company's established quality standards.

Based on the findings of this study, several recommendations are proposed for future research. First, although the Service criterion received the lowest priority weight (0.067), future studies should give greater consideration to this criterion because service quality may directly influence the company's level of trust in its suppliers. Such trust can be developed through service performance indicators, including responsiveness, complaint handling, and effective communication. Improvements in service quality are expected to contribute to stronger and more sustainable supplier relationships.

Second, to produce a more comprehensive supplier evaluation, future studies should incorporate additional criteria to analyze and assess a broader range of relevant factors in the supplier selection process. Third, future research is recommended to apply a more advanced extension of the AHP method, namely the Fuzzy Analytical Hierarchy Process (FAHP), to compare the results obtained using FAHP with those generated by the conventional AHP method applied in this study.

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