Analytical Hierarchy Process Method as a Solution to Fiber Optic Cable Supplier Quality

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Submitted:
17 MAY 2024

Accepted:
28 AUGUST 2024

ABSTRACT

PT Prima Akses Solusi Global faces challenges in selecting fiber optic cable suppliers due to a subjective evaluation process focused mainly on price and product quality. Other factors, such as delivery, service, and payment, are also crucial. To improve effectiveness, this study uses the Analytical Hierarchy Process (AHP) for a more objective approach. AHP evaluates criteria like delivery, quality, service, price, and payment. Data from questionnaires is processed using pairwise comparison weighting. The results indicate that delivery and quality are top priorities, with PT Fiberhome ranking highest (0.417), followed by PT Voksel (0.323), and PT Furukawa (0.260). The AHP method effectively enhances decision-making accuracy in supplier selection. This study recommends ongoing AHP implementation, although it is limited to fiber optic cable supplier evaluation at PT Prima Akses Solusi Global.

Keywords*: Supplier, Fiber Optic Cable, Analytical Hierarchy Process*

ABSTRAK

PT Prima Akses Solusi Global menghadapi tantangan dalam pemilihan supplier kabel fiber optik karena proses evaluasi yang bersifat subyektif, berfokus hanya pada harga dan kualitas produk. Faktor-faktor lain, seperti pengiriman, layanan, dan pembayaran, juga termasuk penting. Untuk meningkatkan efektivitasnya, penelitian ini menggunakan metode Analytical Hierarchy Process (AHP) sebagai pendekatan yang lebih objektif. AHP menilai kriteria pengiriman, kualitas, layanan, harga, dan pembayaran. Data dari kuesioner diolah menggunakan penilaian perbandingan berpasangan (pairwise comparison). Hasilnya menunjukkan bahwa pengiriman dan kualitas adalah prioritas utama, dengan PT Fiberhome menempati peringkat teratas (0,417), diikuti oleh PT Voksel (0,323), dan PT Furukawa (0,260). Metode AHP efektif meningkatkan akurasi dalam pemilihan supplier. Studi ini menyarankan penggunaan AHP secara berkelanjutan, meskipun terbatas pada evaluasi supplier kabel fiber optik di PT Prima Akses Solusi Global.

Kata kunci*: Supplier, Kabel Fiber Optik, Analytical Hierarchy Process*

JIMKES

Jurnal Ilmiah Manajemen Kesatuan
Vol. 12 No. 5, 2024
pp. 2149-2156
IBI Kesatuan
ISSN 2337 – 7860
E-ISSN 2721 – 169X
DOI: 10.37641/jimkes.v12i5.2532

INTRODUCTION

PT Prima Akses Solusi Global is a contractor company engaged in the field of telecommunications network installation, which has a high dependence on fiber optic cable suppliers. Fiber optic cables are the main component in ensuring the smooth installation of quality networks, which is the core of this company's services. However, in practice, supplier selection is often done subjectively, considering several basic factors such as price and product quality. Although these two factors are important, an approach that focuses too much on these aspects can lead to greater operational risks, especially if other factors, such as delivery, service, and payment, are not taken into account comprehensively. This non-comprehensive supplier evaluation can result in non-conformity in the quality and timeliness of material delivery, which ultimately disrupts the efficiency and effectiveness of the company's operations (Jannah et al., 2011; Burton, 2023; Fitriasyach, 2024).

This underscores the need for a more objective supplier evaluation, which not only looks at the price and product quality aspects but also considers other elements that affect the overall supplier performance. This more objective approach will help companies reach more accurate strategic decisions regarding the selection of suppliers that suit their operational needs (Shahroudi & Rouydel, 2012). One method that can be used to overcome this challenge is the Analytical Hierarchy Process (AHP), which is a multi-criteria decision-making method that can break down complex problems into smaller, more manageable components (Kazibudzki & Tadeusz, 2013; Thakkar, 2021). AHP was developed by Thomas (1993) as a tool to help decision-makers compare criteria in pairs, allowing for a more measurable and accurate assessment of each factor. In the context of supplier evaluation, AHP is able to identify important criteria and sub-criteria, assign weights to each factor, and ultimately determine priorities in selecting suppliers that best meet the expected criteria (Lin et al., 2023; Arifin & Vikaliana, 2024).

In this study, AHP is used to evaluate and select fiber optic cable suppliers at PT Prima Akses Solusi Global. The main criteria considered include delivery, quality, service, price, and payment. Each of these criteria plays an important role in determining how well a supplier can optimally meet the company's needs. On-time delivery, product quality that meets standards, responsive service, competitive prices, and ease of payment are factors that form the basis for assessing supplier performance. By implementing AHP, it is hoped that companies can make more measurable and data-based decisions in determining which suppliers to choose, thereby supporting the sustainability and efficiency of the company's operations. This study is expected to not only provide practical benefits for PT Prima Akses Solusi Global in selecting suppliers, but also be a reference for other companies facing similar challenges in supply chain management. Thus, the application of AHP as an evaluation method is expected to increase transparency, objectivity, and accuracy in the supplier selection process, thereby supporting better and more in-depth decision making in the context of supply chain management.

LITERATURE REVIEW

The procurement department is an important element in the supply chain, responsible for providing items and services that support the company's business operations. In addition, the role of procurement also focuses on fostering long-term relationships with suppliers and encouraging innovation in products and services produced by the company (Carter et al., 2007; Pujawan & Mahendrawathi, 2017; Tchokogué & Merminod, 2021). Procurement tasks include designing relationships with suppliers, selecting key suppliers, implementing appropriate technology, maintaining item and supplier data, conducting purchasing processes, and evaluating supplier performance. Supplier performance evaluation is a crucial task in maintaining the company's sustainable competitiveness (Pujawan & Mahendrawathi, 2017; Coskun et al., 2022; Hasidi et al., 2024). Supplier selection is a strategic action that determines the quality of a company's supply chain,

especially if the supplier will work together in the long term or provide important commodities (Pujawan & Mahendrawathi, 2017).

The supplier selection process in the Analytical Hierarchy Process (AHP) method includes several stages, namely determining selection criteria, determining criteria weights, identifying alternatives, evaluating alternatives based on criteria, calculating the weight value of each supplier, and ranking suppliers based on that weight. The decision support system aims to assist in making less structured decisions and is usually faced by managers at the top level (Allaoui et al., 2019). This system is the result of the integration between qualitative models and data collection processes, has interactive features that facilitate human-computer interaction, and is flexible in dealing with changing problems. The use of a decision support system helps in selecting effective alternatives based on the information that has been obtained (Suharnan, 2005; Baron & Branscombe, 2009; Wijaya, 2024).

AHP is a multi-criteria decision-making method developed by Thomas (1993). This method is useful for breaking down complex problems into smaller components, making it easier to analyze and evaluate. AHP uses a hierarchical approach that allows for pairwise comparisons between criteria, with the aim of providing appropriate priority weights based on decision preferences. This method has been widely used in various fields, including supply chain management, to evaluate and prioritize suppliers more accurately (Saaty Thomas, 1993). AHP provides flexibility for companies to adjust the weight of the selected criteria based on specific business needs and objectives (Canco et al., 2019; Riyanto et al., 2022; Chandra, 2023).

METHODS

This study uses a qualitative descriptive approach. The descriptive approach was chosen because it aims to provide a structured and measurable picture of supplier quality assessment based on several main criteria that have been set. Meanwhile, the qualitative aspect functions to explore and understand the preferences and subjective considerations of related parties in supplier assessment. This study was conducted at PT Prima Akses Solusi Global, a telecommunications network installation contractor company located in Jakarta. The research sample consisted of parties who have a direct role in the supplier selection and evaluation process, such as the head of procurement, head of engineering, and head of warehouse. The sampling technique used was purposive sampling, which is selecting respondents based on certain criteria that are relevant to the research objectives, so that they can provide accurate and in-depth information. The types of data used in this study are primary data and secondary data. Primary data were collected through questionnaires distributed to selected respondents at PT Prima Akses Solusi Global. The questionnaire was designed to collect information on the weight and ranking of criteria in supplier evaluation. Meanwhile, secondary data were obtained from company documentation, annual reports, and other relevant sources such as journals or publications related to supplier evaluation using AHP. The data collection techniques used included in-depth interviews and distributing questionnaires containing paired comparisons between criteria, in accordance with the AHP method. Data analysis in this study used the AHP method with seven main stages (Thomas, 1993), namely in the first stage compiling indicators and hierarchical structures. The second stage is pairwise division by respondents making paired comparisons between criteria using the 1-9 AHP scale. This comparison matrix shows the level of importance between criteria based on respondent preferences. The third stage is calculating the weight of the criteria with a geometric mean. The fourth stage of consistency testing is tested by calculating the Consistency Index (CI) and Consistency Ratio (CR). The fifth stage is calculating the weight/priority of each variable at level 2 (sub-criteria). The sixth stage is calculating the weight/priority of each variable at level 3 (alternative). The seventh stage is determining the selected supplier.

RESULTS

Respondents in this study were parties directly involved in the procurement and supplier evaluation process at PT Prima Akses Solusi Global. The main respondents included the Head of Procurement, Head of Engineering, and Head of Warehouse. The selection of respondents was done purposively, namely based on their expertise and role in decision-making related to the selection of fiber optic cable suppliers. Each respondent has experience and in-depth knowledge of the evaluation criteria used, namely delivery, quality, service, price, and payment. In this context, an analysis was carried out on the weight of the criteria and sub-criteria that play an important role in the supplier evaluation process at PT Prima Akses Solusi Global using the Analytical Hierarchy Process (AHP) method.

Table 1. Normalization Matrix and Criteria Priority

Criteria	Shipping	Quality	Service	Price	Payment	Quantity	Vector Eigen
Shipping	0.114	0.095	0.179	0.140	0.164	0.692	0.138
Quality	0.574	0.465	0.451	0.425	0.435	2.35	0.476
Service	0.055	0.088	0.086	0.106	0.084	0.419	0.083
Price	0.192	0.256	0.190	0.234	0.227	1.099	0.219
Payment	0.065	0.096	0.094	0.095	0.090	0.44	0.088
Quantity	1	1	1	1	1	5	

In this context, each main criterion will be further broken down into several sub-criteria to provide a more detailed assessment of the factors relevant to PT Prima Akses Solusi Global. There are five main criteria analyzed in supplier selection.

Table 2. Criteria Normalization Matrix

Criteria	Value	Sub-Criteria	Sub-Criteria Values
Quality	0.476	Conformity of items to specifications	0662
		Provision of items without defects	0.188
		Ability to provide consistent quality	0.148
Price	0.214	Providing discounts with a certain purchase amount	0.628
		Discounts on certain days	0.245
		Appropriateness of price according to quality	0.127
Shipping	0.137	Accuracy of the number of items	0.631
		Delivery time accuracy	0.271
		Ability to fulfill the number of deliveries	0.095
Payment	0.087	Payment advance	0.574
		Grace period of payment	0.223
		Payment suspension	0.203
Service	0.085	Speed in responding to requests	0.638
		Ability to provide clear information	0.216
		Ease of communication	0.146

Quality has the highest value (0.476). The results indicate that the company emphasizes the importance of product quality that meets specifications. This is critical to maintaining the reliability and longevity of cables used in telecommunications networks. The most important sub-criteria in it is "conformity of items to specifications" (0.662), followed by "provision of items without defects" (0.188), and "ability to provide consistent quality" (0.148). Price is the second criterion, with a value of 0.214, emphasizing cost efficiency through competitive price negotiations and discounts on large purchases. The main sub-criteria in price are "giving discounts with certain purchase quantities" (0.628), followed by "discounts on certain days" (0.245) and "price appropriateness according to quality" (0.127). Competitive prices are important for PT Prima Akses Solusi Global to maintain profitability. Delivery is in third place with a value of 0.137, highlighting the importance of punctuality and quantity of items in the delivery process. The main sub-criteria here are "accuracy of quantity of items" (0.631), followed by timeliness of delivery" (0.271) and "ability to meet delivery quantity" (0.095).

Delivery efficiency is needed to ensure smooth operations and additional cost savings. Payment (0.087) is in fourth place, indicating the importance of flexibility in payment to support the company's cash flow. The main sub-criteria are "advance payment" (0.574), followed by "payment grace period" (0.223) and "payment deferral" (0.203). Service has the lowest value (0.085), but is still considered in supplier selection because it plays a role in maintaining long-term relationships. The main service sub-criteria are "speed in responding to requests" (0.638), followed by "ability to provide clear information" (0.216), and "ease of communication" (0.146).

The normalized value of each sub-criteria related to the five main criteria in supplier selection at PT Prima Akses Solusi Global. The calculation process for this value is carried out using the Analytical Hierarchy Process (AHP) method with the help of Expert Choice Software. Each assessment of criteria and sub-criteria has gone through a consistency test, where the Consistency Ratio (CR) value is below 0.1. This shows that the analysis results meet the established consistency standards, so they can be relied on as a basis for decision-making in supplier evaluation. The assessment results using the Analytical Hierarchy Process (AHP) method determine supplier priorities by assessing the performance of alternative suppliers against the identified criteria and sub-criteria.

Table 3. Determination of Supplier Priorities

Supplier	Value	Order
PT Fiberhome	0.417	1
PT Voksel	0.323	2
PT Furukawa	0.260	3

PT Fiberhome is the top priority with the highest score of 0.417. PT Fiberhome has the best performance in quality, delivery, and payment, making it the most optimal choice for PT Prima Akses Solusi Global. This advantage is based on consistency in providing products according to specifications and fast response in delivery and service. PT Voksel is in second place with a score of 0.323. Although not as strong as PT Fiberhome in terms of quality, PT Voksel excels in price, especially in providing discounts for large purchases. PT Furukawa is in third place with a score of 0.260. Although PT Furukawa has an advantage in service, its overall score is still below PT Fiberhome and PT Voksel due to its lower performance in terms of quality and delivery. PT Fiberhome is the best supplier based on the evaluation of the criteria and sub-criteria applied. PT Fiberhome's advantages lie mainly in product quality and speed of service.

Table 4. Supplier Selection Criteria Values

Criteria	Value	Order of Priority
Quality	0.476	1
Price	0.214	2
Shipping	0.137	3
Payment	0.087	4
Service	0.085	5

From the results, it can be seen that the quality criterion has the highest value (0.476), indicating the importance of quality in supplier selection. The price criterion is in second place with a value of 0.214, indicating that cost efficiency is also a major consideration. The delivery, payment, and service criteria are in the next place, with values of 0.137, 0.087, and 0.085, respectively. These priorities indicate the main focus of PT Prima Akses Solusi Global in determining the most appropriate supplier for its operational needs.

This study evaluates the quality of fiber optic cable suppliers at PT Prima Akses Solusi Global using the Analytical Hierarchy Process (AHP) method, which has proven effective in prioritizing suppliers based on various criteria such as quality, price, delivery, payment, and service. Based on the results of the analysis with Expert Choice software, the quality criterion has the highest value (0.476), followed by price (0.214), delivery (0.137),

payment (0.087), and service (0.085). These results indicate that quality is the main factor in supplier selection, in line with research by Sukmawati et al. (2019), which emphasizes the importance of quality in maintaining product standards and customer satisfaction. In the quality criteria, the main sub-criteria are the conformity of items to specifications (0.667), followed by the provision of items without defects (0.186), and quality consistency (0.147).

The highest supplier ranking in this criterion is PT Fiberhome (0.446), indicating that quality consistency is the main priority in supplier evaluation. Price criteria are the second priority with the sub-criteria of discounts with purchase volume (0.628) occupying the top position, followed by discounts on certain days (0.245) and price appropriateness with quality (0.127). In this category, PT Voksel is in the highest position (0.406), indicating the company's preference for more competitive price offers, especially through volume discounts, as supported by research (Riyanto et al., 2022). Delivery criteria are in third place with the main sub-criteria being the accuracy of the quantity of items (0.636), followed by the accuracy of delivery time (0.270), and the ability to meet the number of deliveries (0.094).

PT Fiberhome is again at the top (0.509) in the delivery aspect, indicating that the reliability of material supply is a critical factor in supporting the smooth operation of the company. In the payment criteria, the main sub-criteria are down payment (0.574), followed by payment grace period (0.223), and payment deferral (0.203). PT Fiberhome is in the top position (0.395), indicating that payment flexibility is an important consideration in supplier selection, in accordance with the findings (Sayuti et al., 2020). The service criteria received the lowest score, with the main sub-criteria being the speed of responding to requests (0.638), followed by the ability to provide clear information (0.216), and ease of communication (0.146).

In this category, PT Fiberhome remains superior (0.500), which supports the importance of a quick response in maintaining long-term relationships between companies and suppliers, as emphasized by Wardana et al. (2022). Overall, the evaluation results show that PT Fiberhome obtained the highest total score (0.417), followed by PT Voksel (0.323) and PT Furukawa (0.260). This indicates that PT Fiberhome is the main priority supplier in the selection of fiber optic cable materials at PT Prima Akses Solusi Global, given its consistent performance in various aspects of the criteria considered. The implementation of AHP has been proven to help companies in conducting supplier analysis objectively and in a structured manner, supporting more accurate and data-based strategic decisions (Pramita & Wirawan, 2019; Yazdani et al., 2021).

CONCLUSION

This study demonstrates the effectiveness of the Analytical Hierarchy Process (AHP) in evaluating supplier quality at PT Prima Akses Solusi Global, a company reliant on a sustainable supply chain for productivity and operational efficiency. The AHP method was selected due to its structured approach, allowing systematic evaluation of multiple criteria to match company priorities. Key criteria examined include delivery, quality, price, and flexibility. Among these, delivery and quality ranked highest, underscoring their critical importance to the company. PT Fiberhome emerged as the top supplier, followed by PT Voksel and PT Furukawa, primarily due to superior delivery and quality standards. This ranking enables the company to select suppliers that meet operational standards, enhancing overall efficiency and effectiveness. AHP's application supports transparent and precise decision-making by considering relevant factors comprehensively. With these insights, PT Prima Akses Solusi Global is better positioned to foster long-term, stable relationships with top suppliers, which will directly support smoother, more stable operations. The study also confirms that AHP can be a reliable tool for optimizing supply chain performance and maintaining high service quality.

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