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PEMILIHAN PEMASOK BAHAN BAKU UNTUK KERAJINAN KULIT MENGGUNAKAN METODE ANALITICAL HIERARCHY PROCESS

SELECTION OF RAW MATERIAL SUPPLIERS FOR LEATHER HANDICRAFTS USING THE ANALYTICAL HIERARCHY PROCESS

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Abstrak

Pemasok merupakan faktor penting untuk dipertimbangkan dalam manajemen rantai pasok. Selama ini, MSME House of Makario yang memproduksi strap jam tangan berbahan kulit tidak mempunyai mekanisme tertentu dalam memilih pemilihan pemasok bahan baku kulit. Akibatnya volume, waktu kedatangan, harga, dan kualitas bahan baku tidak sesuai dengan pesanan. Penelitian ini bertujuan menentukan pemasok utama dengan kriteria kualitas, harga, pengiriman, dan pelayanan. Metode yang digunakan yaitu Analytical Hierarchy Process. Pengumpulan data menggunakan kuesioner, wawancara, dan studi literatur. Kuesioner digunakan untuk menentukan kepentingan relatif dari kriteria, sub kriteria, dan alternatif, sedangkan wawancara dan studi literatur digunakan untuk menentukan kriteria. Hasil pengolahan data menunjukkan urutan kriteria prioritas dalam pemilihan pemasok yaitu: kualitas dengan bobot 40%, harga 32%, pengiriman 20%, dan pelayanan 8%. Urutan bobot prioritas pemasok yang terpilih yaitu Pemasok A sebesar 35%, Pemasok B sebesar 34% dan Pemasok C sebesar 31%. Dengan demikian Pemasok A merupakan pemasok yang direkomendasikan sebagai pemasok utama.

Kata kunci: analytical hierarchy process, manajemen rantai pasok, pemilihan pemasok

Abstract

Suppliers are an essential factor to consider in supply chain management. So far, the MSME House of Makario, which produces leather handicrafts, has yet to have a specific mechanism for selecting raw material suppliers. As a result, the arrival time, price, and quality of raw materials must match the order. This research aims to determine the leading suppliers with quality, price, delivery, and service criteria. The method used is the Analytical Hierarchy Process (AHP)—data collection using questionnaires, interviews, and literature studies. The data processing results show the priority criteria: quality with a weight of 40%, price of 32%, delivery at 20%, and service at 8%. The priority weight order of the selected suppliers is Supplier A by 35%, Supplier B by 34%, and Supplier C by 31%. Thus, Supplier A is a supplier that is recommended to be the leading supplier.

Keywords: analytical hierarchy process, supplier selection, supply chain management

I. INTRODUCTION

Effective supply chain management is essential for both small and large industries, particularly in ensuring the continuous availability of raw materials required to sustain production activities. Suppliers represent a critical component of the supply chain, as their performance directly influences production efficiency, cost stability, and the ability of firms to respond to customer demand [1]. In practice, supply chain inefficiencies often manifest through observable operational symptoms such as delayed material delivery, inconsistent quality, and mismatches between ordered and delivered quantities. These symptoms, if not properly managed, may disrupt production continuity and weaken a firm's competitive position [2].

For manufacturing-oriented enterprises, especially those operating under make-to-order production systems, the reliability of raw material suppliers becomes even more critical. Inadequate supplier performance may lead to frequent production interruptions, increased operational costs, and reduced customer satisfaction. Therefore, the selection of appropriate suppliers should not rely solely on informal judgment or past experience, but rather on a structured and objective evaluation process that considers multiple performance criteria relevant to the firm's operational context.

House of Makario is a Micro, Small, and Medium Enterprise (MSME) operating in the leather craft industry, specializing in custom-made watch straps produced using a make-to-order system. Located in Yogyakarta City, this enterprise relies on cow leather as its primary raw material. In practice, several recurring procurement-related symptoms have been identified, including delayed arrival of raw materials, inconsistencies in leather quality and color specifications, and discrepancies between ordered and delivered quantities. These conditions frequently result in material returns and temporary shortages, which ultimately lead to production stoppages and delayed delivery of finished products to customers.

Currently, House of Makario sources cow leather from three different suppliers. The profile of each supplier is presented in Table 1. However, the supplier selection process is not supported by a formal or systematic evaluation mechanism. Procurement decisions are largely based on personal relationships and subjective experience of employees rather than measurable performance indicators. As a result, supplier performance is neither monitored nor compared objectively. This condition represents the core problem addressed in this study, namely the absence of a structured decision-making framework for selecting raw material suppliers that aligns with the operational needs of the enterprise.

The lack of systematic supplier evaluation has led to recurring supply-related disruptions, including delivery delays of up to seven days and the receipt of raw materials that do not meet quality specifications. These issues directly affect production continuity and force the enterprise to repeatedly adjust production schedules. Consequently, operational efficiency declines and additional costs emerge due to rework, material returns, and idle production time.

Supply disruptions and inconsistent raw material quality have significant financial implications for the enterprise. House of Makario applies two pricing strategies to cope with these conditions: increasing product prices to preserve profit margins or maintaining stable prices with minimal margins to remain competitive. Both strategies are highly sensitive to supply uncertainty, particularly when production interruptions occur due to unreliable suppliers. Therefore, a systematic decision-support approach is required to evaluate suppliers based on relevant performance criteria and to minimize procurement-related risks.

Tabel 1. Supplier profile

Supplier	Supplier Characteristic
Supplier A	Raw materials are generally free from major defects
	Leather color is occasionally inconsistent with specifications
	Relatively high price
	Lead time of 6–7 days
	Raw materials are consistently available and delivered on time
	Delivered quantities match the order specifications
	Supplier is easy to contact
	Payment can be made in cash or via bank transfer
Supplier B	Leather color specifications conform to order requirements
	High occurrence of hole defects in raw materials
	Relatively low price with occasional price increases
	Able to meet demand volume
	Delivered quantities sometimes do not match the order
	Lead time of approximately 2 days
	Supplier is difficult to contact and has inflexible ordering schedules
	Payment is made via bank transfer
Supplier C	Leather color specifications conform to order requirements
	Moderate price level
	Presence of thin defects in leather raw materials
	Supplier is easy to contact and offers flexible ordering schedules
	Lead time of 3–4 days
	Delivered quantities generally match the order specifications
	• Frequently unable to meet the required order quantity
	• Payment is made via bank transfer

Supplier selection has long been studied as a multi-criteria decision-making problem, and numerous methods have been proposed to support

prioritization in procurement decisions. Among these methods, the Analytical Hierarchy Process (AHP) has been widely adopted due to its ability to structure complex decision problems and incorporate both qualitative and quantitative criteria in a consistent manner. Previous studies have applied AHP in various selection contexts, such as supplier evaluation, facility location, and partner selection in manufacturing and service industries [3] [4] [5].

Despite the extensive use of AHP in supplier selection studies, most existing research focuses on large-scale manufacturing firms or well-established industrial supply chains. Limited attention has been given to Micro, Small, and Medium Enterprises (MSMEs), particularly those operating under make-to-order systems with high dependency on raw material consistency, such as leather craft industries. Moreover, existing studies rarely address supplier selection problems that arise from informal procurement practices commonly found in MSMEs. This study addresses this gap by applying AHP as a structured decision-support tool tailored to the operational constraints and practical needs of an MSME leather craft enterprise.

Accordingly, this study aims to develop a systematic supplier selection model using the Analytical Hierarchy Process to support raw material procurement decisions at House of Makario. Suppliers are evaluated based on key criteria, namely quality, price, delivery, and service, which are identified as critical factors influencing production continuity. The contribution of this study lies in providing an applicable and transparent supplier selection framework for MSMEs, while extending the application of AHP to small-scale, make-to-order manufacturing contexts. The effectiveness of the proposed model is assessed through the consistency of expert judgments (Consistency Ratio ≤ 0.10) and the clarity of supplier priority rankings produced by the model.

The decision support model in question is designed to decompose complex multi-factor or multi-criteria problems into a hierarchical structure, wherein the hierarchy is conceived as a representation of complex problems in a tiered format. The initial level represents the objective, with subsequent levels delineating factors, criteria, sub-criteria, and so forth, culminating in the final level of alternatives. The decomposition of a complex problem into its constituent groups, subsequent organization of these groups into a hierarchical structure, and the resultant presentation of the problem as more structured and systematic are the fundamental principles of this approach [6].

The implementation of the Analytical Hierarchy Process (AHP) in the context of supplier selection confers numerous benefits, including but not limited to:

1. The system under discussion enables the incorporation of multiple decision-makers' input, thereby ensuring that the evaluation process is not biased toward a single perspective.
2. The methodology for supplier evaluation is characterized by its clarity and transparency, which contribute to an objective and accountable selection process.
3. The Analytical Hierarchy Process (AHP) is a methodological framework that facilitates the consideration of multiple criteria and their relative importance. This capacity enables companies to make well-rounded supplier selection decisions.

The aforementioned advantages culminate in enhanced supplier performance, augmented efficiency within the supply chain, and elevated customer satisfaction. The Analytical Hierarchy Process (AHP) is a practical methodology for supplier selection. It allows companies to evaluate and rank potential suppliers based on multiple criteria.

Aldo and Apri conducted a thorough investigation into the array of feed suppliers for marine fish farming at the Batam Aquaculture Center (BPBL). Utilizing the AHP (Analytical Hierarchy Process) method, they methodically examined the available options, ensuring a comprehensive and systematic approach to their research. The selection of suppliers is determined by a multifaceted set of criteria, including but not limited to considerations such as quality, price, service, delivery time, and warranty provisions. The final result of this study, as determined by the application of the aforementioned five criteria, indicates that Supplier 03 is the selected supplier. This determination is made on the basis of Supplier 03's receipt of the most significant ranking weight, with a value of 4.25. In the subsequent ranking, Supplier 02 holds a value of 3.99 [7].

Firdaus et al. [8] applied the Analytical Hierarchy Process (AHP) to supplier selection in the oil and gas drilling industry at PT KMI by considering administrative, quality, delivery, financial, technical, and price criteria. Their findings demonstrate that AHP is effective in prioritizing suppliers based on multiple operational considerations, with Supplier B identified as the most preferred alternative. Similarly, Dweiri et al. [9] developed an AHP-based decision support system for supplier selection in Pakistan’s

automotive industry using price, quality, delivery, and service criteria, confirming the method's capability to generate clear priority rankings. In the same industrial context, Idrees et al. [10] also emphasized the applicability of AHP for raw material supplier selection by focusing on service, price, and delivery criteria.

In the leather manufacturing sector, Moktadir et al. [11] utilized AHP to evaluate logistics suppliers by incorporating risk-related criteria, including quality improvement, uncertainty minimization, adaptation, waiting time reduction, and transportation facilities. Their results indicate that AHP is suitable for identifying the most resilient supplier under supply chain disruption scenarios. Likewise, Baldah et al. [12] applied AHP in the manufacturing industry in West Java to rank raw material suppliers based on quality, flexibility, delivery, and cost, and successfully identified the optimal supplier alternative.

Although previous studies have demonstrated the robustness of AHP across various industrial sectors, its application in MSME-based leather craft industries remains limited. Therefore, this study aims to determine the most suitable raw material supplier for MSME House of Makario by applying AHP with criteria tailored to its operational characteristics, namely quality, price, delivery, and service.

II. METHOD

This study employs a quantitative decision-support approach using the Analytical Hierarchy Process (AHP) to determine the priority of raw material suppliers. AHP is a widely recognized multi-criteria decision-making (MCDM) method that facilitates structured problem decomposition and systematic evaluation of complex decisions involving both qualitative and quantitative factors [13][14]. The selection of AHP in this study is motivated by its robustness in prioritization problems and its extensive validation in procurement and supplier selection research.

Data collection is conducted through a structured questionnaire administered to the owner and personnel directly involved in raw material procurement at House of Makario. These respondents are selected based on their expertise and decision-making authority, as recommended in expert-based decision-support studies [15]. The questionnaire is designed to capture pairwise comparison judgments among criteria, sub-criteria, and supplier alternatives using Saaty's fundamental scale of 1–9, which reflects relative importance and preference intensity.

The implementation of the Analytical Hierarchy Process follows the standard procedural framework proposed by Saaty [16]. First, the supplier selection problem is decomposed into a hierarchical structure consisting of four levels: the overall goal, evaluation criteria, sub-criteria, and supplier alternatives. This hierarchical modeling approach enhances clarity and ensures logical consistency in complex decision-making problems [14].

Second, pairwise comparison matrices are constructed at each hierarchical level to evaluate the relative importance of decision elements. Respondents provide judgments using a numerical scale ranging from 1 (equal importance) to 9 (extreme importance). To aggregate multiple expert judgments into a single comparison matrix, the geometric mean method is applied, as recommended for group decision-making in AHP-based studies [17].

Third, each comparison matrix is normalized by dividing each element by the sum of its corresponding column. The priority weight of each criterion, sub-criterion, and alternative is then obtained by averaging the normalized values in each row. This approach approximates the principal eigenvector and has been widely adopted in applied AHP research due to its computational efficiency and reliability [15].

Consistency evaluation is performed to ensure the reliability of expert judgments. The maximum eigenvalue (λ_max) is calculated and used to derive the Consistency Index (CI), which is defined as $(\lambda\_max - n) / (n - 1)$, where n represents the matrix size. The Consistency Ratio (CR) is subsequently computed by dividing the CI value by the corresponding Random Index (RI) provided by Saaty [18]. A pairwise comparison matrix is considered acceptable if the CR value is less than or equal to 0.10, indicating a reasonable level of judgment consistency.

Finally, the global priority of each supplier is determined by synthesizing the weights across hierarchical levels. This is achieved by multiplying the normalized weights of sub-criteria by the corresponding normalized weights of supplier alternatives and summing the results to obtain the final global weight. The supplier with the highest global weight is identified as the most preferred alternative. This global priority value serves as the primary quantitative indicator of model effectiveness and supplier performance, consistent with prior supplier selection studies using AHP [19].

The collection of data is facilitated through the administration of a questionnaire, which is provided

to the owner and the personnel responsible for the procurement of raw materials. The importance comparison questionnaire is predicated on criteria, sub-criteria, and supplier alternatives. The questionnaire is structured according to a hierarchical arrangement, as illustrated in **Figure 1**.

The data that has been collected is processed with the AHP method, following the following steps:

1). The development of a hierarchical structure is imperative for the effective description of problems that consist of objectives, criteria, sub-criteria, and alternatives in the selection of a supplier.
2). The creation of a comparative matrix is imperative for the analysis of multiple categories, with each category being assessed based on a set of criteria, sub-criteria, and alternatives for each criterion. The comparison questionnaire was completed by respondents who met the specified criteria, as outlined in **Table 2**.
3). The results of the pairwise comparison matrix in each category are averaged using Geomean. Geometric mean is employed to synthesize group judgments to ensure that the final results remain logical, consistent, and unbiased by extreme values provided by individual respondents.
4). The calculation of normalized columns within each category is achieved by dividing each element in a given column by the number of columns utilizing the value of pairwise comparisons with geomeans.
5). The normalized weight (w) is to be calculated in each category through the averaging of the values in the normalized column in each row.
6). The calculation of the eigenvalue for each category is achieved by summing the values. The comparison value of each column is then multiplied by the Normalized Weight value (w), and the resultant value is averaged. Subsequently, the value of λ_(max) must be ascertained.
7). The Consistency Index (CI) value is to be calculated in each category by subtracting n from λmax, where n corresponds to the matrix size in each category, and then dividing by n-1.
8). The Consistency Ratio (CR) value for each category is determined by dividing the CI value by the corresponding random index. In the event that the CR value is less than or equal to 0.1, the data collection and processing are considered valid. However, if the CR value exceeds 0.1, the data is deemed inconsistent and must be collected or processed again.
9). Calculate the Global Weight of each alternative or Supplier A, Supplier B, and Supplier C. Calculation of the Global Weight of each supplier is done by multiplying the Normalized Weight value of each sub-criteria by the Normalized Weight value of each supplier based on the sub-criteria. The multiplication value between the alternative values (suppliers) is summed up to get the final weight value.

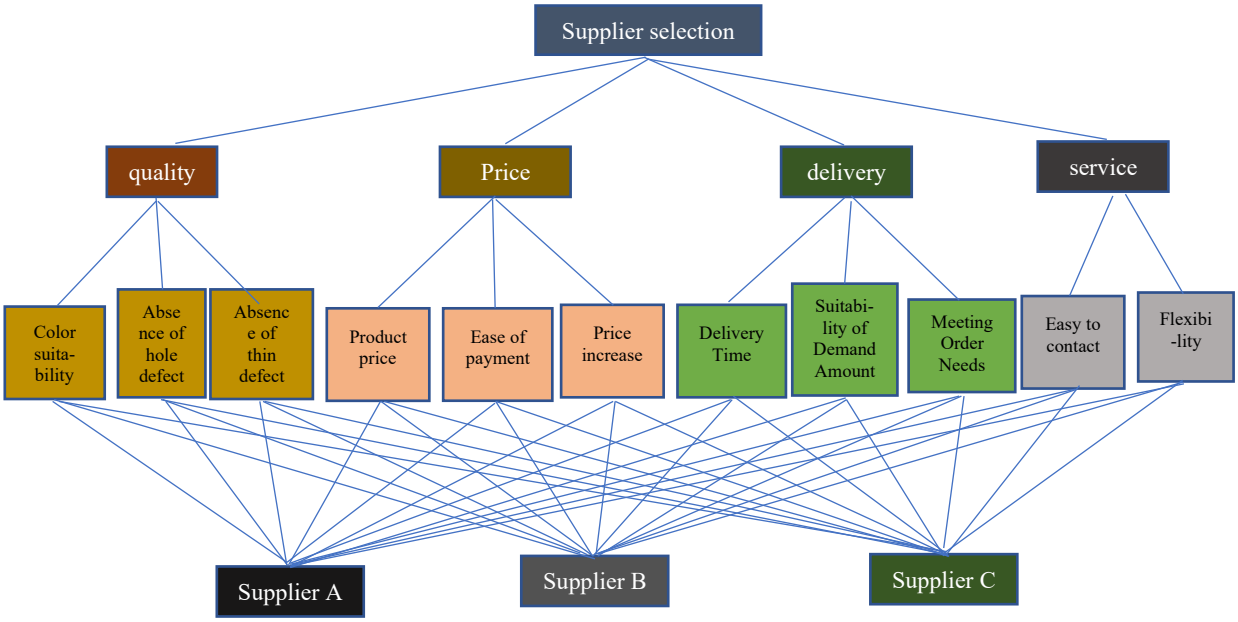

Figure 1 Hierarchical Structure in Supplier Selection

Tabel 2. Explanation of filling score [14]

Value	Verbal judgement
1	Equally important
3	Moderately more important.
5	Strongly important
7	Very strongly important
9	Extremely more important.
2,4,6,8	Values between the two adjacent consideration values

Criteria is a measure that is the basis for assessment in supplier selection. The criteria used are as follows:

a. Quality (K)
Quality is the totality and characteristics of a good or service that can satisfy consumer needs [20]. The following are the quality sub-criteria:
1) Color conformity (K1)
Color conformity is the extent to which a product's color characteristics can meet consumers' desired or specified color standards.
2) Absence of hole defects (K2)
Without hole defects, assess suppliers in terms of the quality of raw materials without defects in the form of holes.
3) Absence of thin defects (K3)
Without thin defects, assess suppliers regarding the quality of raw materials without defects in thin wrinkles.

b. Price (H)
Price is the expenditure made by a company to obtain goods or services [20]. The following are the price sub-criteria:
1) Product price (H1)
Product price is the value of money the company determines to obtain an item to satisfy customer desires.
2) Ease of payment (H2)
Ease of payment is consumers' effectiveness and efficiency in carrying out payment transactions through easy stages [21]. Ease of payment assesses suppliers regarding raw material payment systems such as cash payments or via transfers.
3) Price increases (H3)
Price increases is the process of continuously increasing the price of raw materials or services within a certain period.

c. Delivery (P)
Delivery is the activity of producers in distributing goods and services to fulfill and handle consumer demand. The following are the delivery sub-criteria:
1) Delivery time (P1)
Delivery time is the amount of time it takes for producers to fulfill consumer orders, starting when the order is placed until the ordered material reaches the consumer [22].
2) Suitability of demand amount (P2)
The suitability of the number of requests matches the number of items requested and received [23].
3) Meeting order needs (P3)
Meeting order needs is the ability of producers to fulfill a certain quantity of goods requested or ordered [20].

d. Service (S)
Service is an effort to serve or meet consumer needs with a level of satisfaction that can only be felt by the person providing or receiving the service. The following are the service sub-criteria:
1) Easy to contact (S1)
Easy-to-contact assesses suppliers regarding the ease manufacturers can contact suppliers to place orders, such as through telephone calls [24].
2) Flexibility (S2)
Flexible assesses suppliers regarding their ability to meet demand for changes over time. For example, suppliers can fulfill orders without excluding certain times [22].

III. RESULTS AND DISCUSSION.

This section presents the results of the Analytical Hierarchy Process (AHP) analysis and provides an in-depth discussion of supplier priorities based on the established criteria and sub-criteria. **Tables 4–9** summarize the priority weights derived from pairwise comparisons that were validated through consistency ratio testing (CR $\leq$ 0.10), indicating reliable expert judgments (Tabel 3).

Table 3. *Consistency Ratio*

	CR	Remarks
criteria comparison	0,008	consistent
comparison of quality sub-criteria	0,042	consistent
comparison of price sub-criteria	0,069	consistent
comparison of delivery sub-criteria	0,024	consistent
comparison of service sub-criteria	0	consistent
alternatives under the quality criterion	0,025	consistent
alternatives under the price criterion	0,095	consistent
alternatives under the delivery criterion	0,028	consistent
alternatives under the service criterion	0,044	consistent
alternatives under the color conformity sub-criterion	0,005	consistent
alternatives under the hole defects sub-criterion	0,03	consistent
alternatives under the absence of thin defects sub-criterion	0,053	consistent
alternatives under the raw material price sub-criterion	0,028	consistent
alternatives under the ease of payment sub-criterion	0,002	consistent
alternatives under the price increases sub-criterion	0,017	consistent
alternatives under the delivery time sub-criterion	0,065	consistent
alternatives under the order quantity conformity sub-criterion	0,027	consistent

Table 4 Weight on Each Criteria

Criteria	**Weight**
Quality	0,40
Price	0,30
Delivery	0,20
Service	0,10

Table 5 Weight on Quality Sub-Criteria

Sub-Criteria	**Weight**
Color conformity	0,32
Hole defects	0,37
Absence of thin defects	0,31

Table 6 Weight on Price Sub-Criteria

Sub-Criteria	**weight**
Product price	0,54
Ease of payment	0,17
Price increases	0,29

Table 7 Weight on Delivery Sub-Criteria

Sub-Criteria	**weight**
Delivery time	0,50
Suitability of demand amount	0,30
Meeting order needs	0,20

Table 8 Weight on Service Sub Criteria

Sub-criteria	**Weight**
Easy to contact	0,50
flexibility	0,50

The results show that quality is the most influential criterion in supplier selection, with a weight of 0.40, followed by price (0.30), delivery (0.20)**,** and service (0.10) (Table 4). This priority structure reflects the operational characteristics of House of Makario as a make-to-order leather craft MSME, where product quality directly determines customer satisfaction and brand reputation.

The dominance of quality as the primary criterion is consistent with previous studies in leather and craft-based manufacturing industries, which emphasize material consistency and defect minimization as critical success factors. In contrast, service receives the lowest weight, indicating that while service attributes remain relevant, they are considered supportive rather than decisive in procurement decisions for this enterprise.

Table 9. Alternative Weight on Each Sub-Criterion

Criteria	Weight of criteria	Sub-criteria	Weight of sub-criteria	Alternatif	Bobot	Bobot Lokal
	0,4	color conformity	0,32	*Supplier* A	0,11	0,01
				Supplier B	0,41	0,05
				Supplier C	0,48	0,06
				Supplier A	0,57	0,08

Quality		absence of hole defects	0,37	*Supplier* B	0,1	0,01
				Supplier C	0,33	0,05
		absence of thin defects	0,31	*Supplier* A	0,57	0,07
				Supplier B	0,35	0,04
				Supplier C	0,08	0,01
Price	0,32	competitive performance in product price	0,54	*Supplier* A	0,09	0,02
				Supplier B	0,65	0,11
				Supplier C	0,26	0,04
		Ease of payment	0,17	*Supplier* A	0,66	0,04
				Supplier B	0,16	0,01
				Supplier C	0,18	0,01
		price increases	0,29	*Supplier* A	0,40	0,04
				Supplier B	0,09	0,01
				Supplier C	0,50	0,05
Delivery	0,2	delivery time	0,55	*Supplier* A	0,09	0,01
				Supplier B	0,66	0,07
				Supplier C	0,25	0,03
		Suitability of demand amount	0,27	*Supplier* A	0,4	0,02
				Supplier B	0,11	0,01
				Supplier C	0,49	0,03
		meeting order needs	0,18	*Supplier* A	0,42	0,02
				Supplier B	0,47	0,02
				Supplier C	0,11	0,004
Service	0,08	ease of contact	0,5	*Supplier* A	0,48	0,02
				Supplier B	0,12	0,005
				Supplier C	0,4	0,02
		flexibility	0,5	*Supplier* A	0,61	0,02
				Supplier B	0,11	0,004
				Supplier C	0,28	0,01

Within the quality criterion, the sub-criterion absence of hole defects (0.37) emerges as the most critical factor, followed by color conformity (0.32) and absence of thin defects (0.31) (**Table 5**). This result highlights that structural integrity of leather is prioritized over aesthetic considerations, as hole defects directly affect product usability and increase material rejection rates.

For the price criterion, product price (0.54) is identified as the dominant sub-criterion, while price increases (0.29) and ease of payment (0.17) follow (**Table 6**). This indicates that although MSMEs are sensitive to cost, they also value predictable pricing to reduce financial uncertainty, especially under fluctuating raw material markets.

Regarding delivery, delivery time (0.50) is prioritized over suitability of demand amount (0.30) and meeting order needs (0.20) (**Table 7**). This result aligns with the make-to-order production system adopted by House of Makario, where delays in raw material arrival can directly halt production activities.

For the service criterion, ease of contact and flexibility are assigned equal weights (0.50 each) (**Table 8**), suggesting that communication accessibility and ordering adaptability are equally important for maintaining smooth supplier relationships.

Supplier Performance Evaluation

The alternative evaluation results (**Table 9**) reveal differentiated strengths among suppliers across sub-criteria. Supplier A demonstrates superior performance in quality-related sub-criteria, particularly in absence of hole defects (0.57) and absence of thin defects (0.57)**,** indicating consistent material reliability. Additionally, Supplier A excels in service-related aspects, including ease of contact (0.48) and flexibility (0.61)**.**

Supplier B shows competitive performance in product price (0.65)**,** delivery time (0.66)**,** and meeting order needs (0.47)**,** making it attractive in cost and responsiveness dimensions. However, its lower scores in quality sub-criteria reduce its overall priority ranking.

Supplier C performs strongly in color conformity (0.48) and price increases (0.50) but exhibits weaknesses in fulfilling order quantities and meeting demand consistency, which limits its suitability as a primary supplier.

Global Priority and Managerial Implications

The synthesis of all criteria and sub-criteria results in global priority weights of 0.35 for Supplier A**,** 0.34 for Supplier B**,** and 0.31 for Supplier C (**Table 10**).

Although the differences among suppliers are relatively narrow, Supplier A emerges as the most preferred alternative due to its strong performance in the most critical criterion—quality.

Table 10. Total Weight of Each Alternative

Alternative	weight
Supplier A	0,35
Supplier B	0,34
Supplier C	0,31

From a managerial perspective, this finding suggests that prioritizing Supplier A as the primary supplier can reduce production disruptions caused by material defects and rework. Supplier B may serve as a strategic secondary supplier to mitigate delivery risks, while Supplier C can be considered for specific orders requiring color precision or price increases. This diversified sourcing strategy enhances supply chain resilience for MSMEs operating under make-to-order systems.

Comparison with Previous Studies

The findings of this study are largely consistent with the existing body of literature on supplier selection using the Analytical Hierarchy Process (AHP), while also offering contextual distinctions specific to MSME-based leather craft industries. Numerous previous studies have confirmed that AHP is an effective method for prioritizing suppliers in multi-criteria decision-making environments, particularly in manufacturing and supply chain contexts. For instance, prior research has demonstrated the robustness of AHP in structuring supplier evaluation problems and generating consistent priority rankings across criteria such as quality, price, delivery, and service.

In line with studies conducted in manufacturing and raw material–intensive industries, this research confirms quality as the most influential criterion in supplier selection. Similar dominance of quality-related factors has been reported in supplier evaluation studies within leather manufacturing, automotive, and oil and gas sectors, where material defects and inconsistency directly affect production efficiency and cost performance. However, unlike studies conducted in large-scale industries where price or cost efficiency often emerges as the primary criterion, the present study highlights that MSMEs operating under a make-to-order system place greater emphasis on material quality to prevent production stoppages and rework.

Previous research has also applied AHP to supplier selection by incorporating delivery and service criteria; however, these criteria are frequently treated as secondary factors. This study supports that perspective, as delivery and service are ranked below quality and price. Nevertheless, the relative importance of delivery time in this study is higher than in some prior works, reflecting the vulnerability of small-scale enterprises to supply delays due to limited inventory buffers.

In comparison to earlier studies that primarily focus on ranking suppliers, this research extends the practical contribution by explicitly linking supplier priority results to managerial implications, such as the formulation of a diversified sourcing strategy. While many studies conclude with the identification of a single best supplier, the present study demonstrates how alternative suppliers can be strategically positioned to balance quality, cost, and delivery risks in MSME supply chains.

Overall, this study reinforces the applicability of AHP as a decision-support tool while contributing empirical evidence from an underrepresented context—MSME leather craft industries in developing economies. This contextual contribution addresses a gap in the literature and supports the adaptability of AHP for small-scale, make-to-order manufacturing environments.

The results of the AHP data processing clearly indicate that Supplier A has 35% of the total overall weight based on criteria and sub-criteria, Supplier B has 34%, and Supplier C has 31%. The results are clear: Supplier A, Supplier B, and Supplier C are the top priorities for supplier selection at MSME House of Makario. Supplier A is the clear choice for selection. Supplier A's commitment to quality raw materials, unmarred by holes or thin defects, and its superior service, marked by seamless communication and flexible order scheduling, is undoubtedly the driving force behind these results. These results make it clear: Supplier A is the obvious choice as a long-term partner. Supplier A's track record speaks for itself when it comes to contract management and agreement performance. They consistently deliver top-quality leather raw materials — no holes, no thin materials. This ensures product quality and keeps the production process running smoothly. No more delays due to reordering substandard materials. Supplier A fulfills the fixed-price contract by providing a consistent price, reducing production

costs, and providing benefits to MSME House of Makario.

IV. CONCLUSION

This study develops an AHP-based decision support model to address supplier selection problems in an MSME leather craft enterprise operating under a make-to-order system. The results indicate that quality is the most critical criterion (40%), followed by price (30%), delivery (20%), and service (10%), highlighting the importance of defect-free raw materials for ensuring production continuity and customer satisfaction.

The global priority analysis identifies Supplier A as the most preferred supplier (0.35), slightly outperforming Supplier B (0.34) and Supplier C (0.31). Although the differences among suppliers are marginal, Supplier A demonstrates superior performance in quality-related criteria, making it the most suitable primary supplier. The findings also suggest that a complementary multi-supplier strategy can be adopted to balance quality, cost, and delivery risks.

This research confirms the effectiveness of AHP in providing a structured, transparent, and consistent framework for supplier selection in MSMEs that previously relied on subjective judgment. The proposed model contributes empirically to supplier selection literature by demonstrating the applicability of AHP in small-scale, make-to-order manufacturing contexts. Future studies may enhance the model by incorporating uncertainty-handling approaches or additional sustainability and risk-related criteria.

The results clearly indicate that the order of criteria for supplier selection is quality (K) because it has the highest weight of 40%. The second priority is price (H) at 32%, the third is delivery (P) at 20%, and the last is service (S) at 8%. The order of priority sub-criteria is as follows: the absence of hole defects, color suitability, and finally, the absence of thin defects. The order of the prioritized sub-criteria in the price criteria is price of raw materials, price increases, and ease of payment. The delivery criteria establish a clear hierarchy of priorities: delivery time, order quantity, and order requirements. The service criteria clearly state that the sub-criteria of being easy to contact and flexible have equal weight.

Supplier A is the clear choice for selection and prioritization at MSMES House of Makario, boasting a substantial 35% weight compared to the other two suppliers. At the same time, Supplier B is a clear choice with a weight of 34%. The results make it clear: Supplier A is the best choice for a long-term partnership. Supplier A consistently delivers top-quality leather raw materials, free of holes and with the perfect thickness, ensuring product quality and a smooth production process. Supplier A fulfills the fixed-price contract by providing a consistent price. This reduces production costs and benefits MSMEs at House of Makario.

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