# Developing Vendor Evaluation Model for Third-Party Manufacturing: Vendor Management System in SMEs Fashion Industries

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## ABSTRACT

*Outsourcing is extensively adopted by fashion SMEs, with many SMEs experiencing problems with such activities, such as high defect rates, inconsistent delivery, poor communication, and low bargaining power. These problems often arise due to the fact that vendor evaluation is informal and has no clear criteria. This study develops a vendor evaluation model using the Analytic Hierarchy Process (AHP) to assist SMEs in making more structured decisions. The research comprised three phases: validation of vendor selection criteria based on the BCOR framework, inputs from nine fashion business owners via a structured questionnaire, and calculation of criteria weights with AHP for two groups of SMEs. Since the patterns of judgment between the two groups were similar, a single weighting model was created. A numerical example of three vendors and a sensitivity analysis were then performed. Results show that Cost and Risk are the most important criteria, with production cost, risk of inconsistency in quality, and vendor reputation being important subcriteria. The model proved to be very stable and can help SMEs to evaluate vendors more objectively.*

**KEYWORDS**  *Vendor Selection, Fashion SMEs, BCOR Framework, Outsourced Production, Sensitivity analysis, Vendor Management system*

## INTRODUCTION

The Indonesian fashion industry has developed tremendously within the last ten years, due to rising consumer demand and the emergence of small and medium enterprises (SMEs). Such enterprises are important in the sustainability of local economies and in the promotion of creative entrepreneurship. SMEs in the fashion industry, however, are mostly affected by structural and operational difficulties, especially in the production stage. Most of them depend on third-party manufacturers (*maklon*) since they lack their own production facilities (Delicia et al., 2025; Frank et al., 2019). Although outsourcing is flexible and cost-effective, it presents some threats, such as lack of uniformity, delays in delivery, and poor quality control in production (Contreras, 2020; Ikumapayi et al., 2020; Namadi, 2023; Singh et al., 2016; Vaghani, 2024). In the case of Terra, which is a modest-fashion SME in Indonesia, the same issues were observed. The company was experiencing frequent product defects, unreliable delivery schedules, and problems in coordinating with its vendors (Jonsson et al., 2024; Myrelid, 2017). The absence of an organized system for vendor assessment made it hard to compare supplier performance, establish clear expectations, and implement corrective measures when problems arose. This led to production inefficiency and customer dissatisfaction (Goshime et al., 2019; Mushavhanamadi & Xundu, 2018).

Several previous studies have examined supplier selection and evaluation in various industries. Research by Suryanto et al. (2021) found that the lack of formal decision-making tools in supplier selection is among the greatest weaknesses of Indonesian apparel SMEs, as they rely on intuition or past experience instead of systematic approaches, resulting in

inconsistent outcomes. This situation exposes SMEs to production disruptions and restricts their capacity to scale effectively. Another study by Kurniawan and Sari (2023) investigated supplier selection problems in Indonesian apparel SMEs using multi-criteria decision-making techniques, finding that quality, delivery reliability, and cost were the primary considerations, but most SMEs lacked structured evaluation frameworks. Furthermore, research by Caristi et al. (2022) applied multi-criteria approaches for supplier selection in the fashion industry, demonstrating that the Analytic Hierarchy Process (AHP) enhanced transparency, consistency, and accountability in the supplier selection process, particularly in industries with numerous performance dimensions to consider. Eka and Fasya (2022) also examined supplier selection criteria in Indonesian fashion SMEs, identifying that factors such as production quality, delivery timeliness, and communication responsiveness were critical yet rarely evaluated systematically. Lopes and Rodriguez-Lopez (2021) emphasized that in textile and apparel industries, where multiple performance dimensions must be considered, structured decision-making tools like AHP are essential for objective vendor evaluation.

However, most previous research has focused on large enterprises or general supplier selection without specifically addressing the unique challenges faced by fashion SMEs in Indonesia, particularly those operating in the modest fashion segment. Studies that specifically examine vendor evaluation models integrating the BCOR framework (Benefit, Cost, Opportunity, Risk) with AHP for fashion SMEs remain limited. Additionally, research comparing evaluation priorities between growing and mature SMEs based on revenue levels has not been extensively conducted (Gherhes et al., 2016; Sanchez, 2022; Virkkala et al., 2020). Therefore, this study differs from and builds upon previous research by developing a vendor evaluation model specifically for fashion SMEs using the BCOR framework and AHP, with validation from nine fashion business owners across two revenue-based groups, and including sensitivity analysis to test model stability (Alhammadi et al., 2015; Ara et al., 2025; Kaushik et al., 2020; Rehman & Wang, 2022).

To solve this issue, several scholars have proposed the application of multi-criteria decision-making (MCDM) techniques, including the Analytic Hierarchy Process (AHP). AHP enables decision-makers to assess a variety of criteria, whether qualitative or quantitative, and prioritize them (Caristi et al., 2022; Bhargava, 2024). Research indicates that AHP enhances transparency, consistency, and accountability in the supplier selection process, particularly in industries such as textile and apparel, where numerous performance dimensions must be considered (Eka and Fasya, 2022; Lopes and Rodriguez-Lopez, 2021). The present study, based on these findings, constructs a systematic vendor assessment model for use in fashion SMEs. The model combines the BCOR framework—Benefit, Cost, Opportunity, and Risk—with AHP to enable SMEs to evaluate vendors more systematically. It aims to create a straightforward yet effective tool that can help business owners make better decisions regarding vendors despite limited resources.

Production Cycle 1 (April–June 2024): In its first production batch, the products were Abaya Crinkle manufactured by an external supplier. The total pieces received by the company in this period were 126, of which 25 pieces were rejected, leading to a reject rate of 19.8%. The chief reasons for rejection were associated with fabric defects, improper stitching, and

imprecise cutting, which affected the overall quality of the product. The table below provides the summary of the initial production cycle.

**Table 1. First Production Batch (April–June 2024)**

| Product Type | Color | Total Produced | QC Pass | Reject | % Reject |
|---|---|---|---|---|---|
| Abaya Crinkle | Black | 33 | 26 | 7 | 21.2% |
| Abaya Crinkle | White | 24 | 17 | 7 | 29.2% |
| Abaya Crinkle | Maroon | 24 | 18 | 6 | 25.0% |
| Abaya Crinkle | Brown | 24 | 20 | 4 | 16.7% |
| Abaya Crinkle | Pink | 21 | 20 | 1 | 4.8% |
| Total | | 126 | 101 | 25 | 19.8% |

Source: Terra Company Production Records (2024)

Order Date: April 18, 2024 Finished: May 17, 2024 QC Inspection: May 20, 2024 and Rework was completed on June 22, 2024.

Based on this finding, it was clear that a majority of the quality problems were caused by inappropriate vendor management and a lack of pre-production inspection. Another area where the vendor failed in their communication was the fact that they did not raise unclear specifications for clarification prior to production, resulting in inconsistent production. Despite the order being placed on time, the reject rate was high, incurring additional costs and requiring rework.

There was a reduced order quantity in the second production at 257 pieces, but surprisingly, the reject rate was high at 27.9%, or 74 defective items. The reasons were like those of the initial batch, where stitching and finishing were the primary problems, which meant that the previous quality problems had not been fully addressed. The failure of the second production cycle is shown below.

**Table 2. Second Production Batch (July–November 2024)**

| Product Type | Total Produced | QC Pass | Reject | % Reject |
|---|---|---|---|---|
| Cargo Abaya | 105 | 70 | 35 | 33.3% |
| Khimar | 67 | 53 | 14 | 20.9% |
| Round Hijab | 85 | 60 | 25 | 29.4% |
| Total Reject Rate | 257 | 183 | 74 | 27.9% |

Source: Terra Company Production Records (2024)

Order date: July 26, 2024 Sent: September 3, 2024QC QC Inspection: Sep 9, 2024 Reworked: Nov 27, 2024.

The reject rate increased significantly to 27.9% in the second production cycle. This rise is a sign of poor vendor performance even after feedback. The flaws consisted of wrong cutting patterns, inconsistent thread color, and wrinkled finish, which implied poor supervision of the process. The rework took almost three months, resulting in a significant backlog of new designs and a consumption of working capital tied up in work-in-process.

Production Performance Comparison: The outcomes of each of the production cycles are summarized in Figure 1, which shows the variation in the reject rate and defect types between the two production batches.
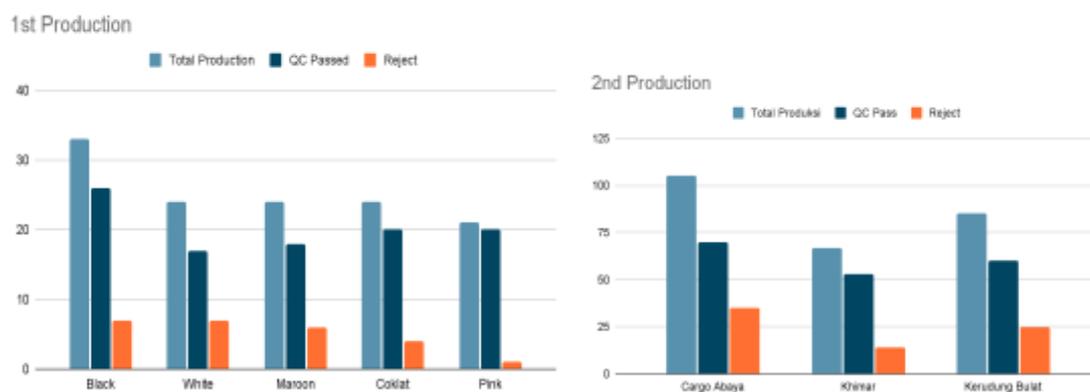


**Figure 1. Figure 1. Comparison of Production Defect Rates in Two Cycles**
Source: Terra Company Production Records (2024)

Based on the figure, it may be observed that the overall defect rate of the second production batch was greater even though the production volume was lower. This means that the vendor did not improve their process after the initial batch was completed. It also highlights the absence of systematic evaluation criteria for vendor selection and monitoring. The repetition of issues, such as quality control failures, vague specifications, and delays in communication, underlines the lack of standardization of the Vendor Management System (VMS). The following are the key research questions that this study will seek to answer: What are the most significant vendor evaluation and selection criteria in the fashion SME setting? In what ways can a quantitative model of structured selection based on the AHP be developed to aid the selection of vendors in SMEs? How can the developed model be applied to compare and prioritize vendors?

The objectives of this study are based on the above questions: To identify and rank the main vendor selection criteria applicable to the operations of fashion SMEs. To develop a quantitative vendor assessment model based on AHP and weighted scoring that would be applicable to SMEs. To apply the model in a fashion SME case and discuss the ranking of vendors according to objective performance scores. The benefits of this research are multifaceted. For fashion SMEs, this study provides a practical and structured tool for vendor evaluation that can reduce subjectivity and improve decision quality, potentially lowering defect rates and improving production consistency. For Terra and similar SMEs, the model offers a systematic approach to address the high reject rates observed in production cycles,

which reached 19.8% in the first batch and 27.9% in the second batch, demonstrating the urgent need for improved vendor selection. For academics and researchers, this study contributes to the literature on vendor selection in SMEs, particularly in the fashion industry, and demonstrates the application of AHP with the BOCR framework in the Indonesian context. For vendors, the model provides clear performance criteria that can guide improvement efforts and foster better communication with SME clients. For the broader fashion industry, this research supports the development of more professional and efficient supply chain practices, ultimately enhancing the competitiveness of Indonesian fashion SMEs in both domestic and international markets.

## RESEARCH METHOD

The data were gathered using online questionnaires administered through Google Forms. This was done in two stages: Model Validation Questionnaire — This step was to ensure that the suggested AHP criteria (BOCR and its sub-criteria) were all-encompassing and applicable in assessing fashion vendors. The relevance and sufficiency of each criterion were measured by the respondents using a Likert-type scale (Very Irrelevant to Highly Relevant). AHP Pairwise Comparison Questionnaire — The second questionnaire was presented after validation of the model and requested the respondents to compare pairs of criteria according to their significance in vendor selection. It was based on a 1–9 scale, with 1 meaning that the factors were equally important and 9 meaning that one factor was significantly more important than the other. The obtained pairwise matrices were processed through Super Decisions to derive the local weights, consistency ratios, and global weights.

The data in this study were analyzed following the steps of the Analytic Hierarchy Process (AHP): Construction of Hierarchy — The AHP model structure was constructed comprising the goal, main criteria (BOCR), and sub-criteria. Pairwise Comparison — Respondents were asked to make judgments regarding the relative importance of each element. Priority Weight Calculation — The local and global weights of criteria and sub-criteria were calculated based on the eigenvector approach in Super Decisions. Consistency Ratio Check — The logical consistency of respondents' judgments was evaluated (considered acceptable when CR ≤ 0.1). Model Aggregation — Group findings were combined to produce a collective weighting model for SMEs. Numerical Example and Sensitivity Analysis — The model was applied to actual vendor options, and the sensitivity of the results to variations in criteria weights was tested. This process enabled the study to produce a structured, quantifiable, and validated vendor evaluation model feasible for use in fashion SMEs.

The validity of the research model was supported by the model validation questionnaire, through which respondents indicated that the developed BOCR-based criteria reflected the reality of vendor selection in fashion SMEs reasonably well. The consistency ratio (CR) calculation in AHP established the reliability of the analysis. A CR of less than 0.1 indicated that there was reasonable consistency in the pairwise judgments. Sensitivity analysis was also conducted to examine the stability of the ranking results, confirming that the model remained reliable even when criteria weights varied marginally.

## RESULT AND DISCUSSION

**Comparative Analysis**

In this section, the AHP findings between Group 1 (Growing SMEs - Revenue < IDR 75 million) and Group 2 (Mature SMEs - Revenue > IDR 75 million) of this research are compared to identify whether they should be evaluated using different weighting systems or not.

**Table 3. Comparison of Criteria Level Weights Between SME Groups**

| Criteria | Group 1 (<75M) | Group 2 (>75M) | Difference | Interpretation |
|----------|----------------|----------------|------------|----------------|
| Benefit | 0.1686 | 0.0932 | +0.0754 | Relational benefits and the service benefits are more important to smaller SMEs. |
| Cost | 0.3679 | 0.5116 | -0.1437 | Established SMEs look at cost effectiveness and volume of production. |
| Opportunity | 0.0956 | 0.1001 | -0.0045 | Virtually the same with both groups. |
| Risk | 0.3679 | 0.2948 | +0.0731 | Smaller SMEs are risk-averse because they do not have a substantial buffer as far as the operation is concerned. |

Source: Primary Data Analysis (2025)

The Cost and Risk are found to be predominant criteria of both groups with the pragmatic character of SME operations. Nevertheless, established SMEs incline to cost control more, whereas smaller SMEs have equally focusing cost and risk reduction.

**Table 4. Benefit Cluster**

| Sub-Criteria | Group 1 (<75M) | Group 2 (>75M) | Observation |
|--------------|----------------|----------------|-------------|
| Reputation & Experience | 0.3943 | 0.4875 | Both value it highly, more important for mature SMEs |
| Service Responsiveness | 0.2867 | 0.2085 | More important for smaller SMEs |
| Trust & Relationship | 0.2234 | 0.2085 | Nearly similar |
| Delivery Performance | 0.0956 | 0.0956 | Identical |

Source: Primary Data Analysis (2025)

Same benefit structure but proportions change slightly, small SMEs have much more importance on service responsiveness, but mature SMEs use reputation.

**Table 5. Cost Cluster**

| Sub-Criteria | Group 1 (<75M) | Group 2 (>75M) | Observation |
|---|---|---|---|
| Production Cost | 0.7471 | 0.5146 | Both highest, stronger focus in small SMEs |
| Payment Inflexibility | 0.1336 | 0.3879 | Mature SMEs care more about payment flexibility |
| Transaction & Coordination | 0.1194 | 0.0975 | Almost equal minor weight |

Source: Primary Data Analysis (2025)

They place importance on the cost of production yet mature SMEs spread the concern to terms of payment implying that they can manage their financial matters broadly.

a. Opportunity Cluster

**Table 6. Opportunity Cluster**

| Sub-Criteria | Group 1 | Group 2 | Observation |
|---|---|---|---|
| Brand Alignment | 0.4600 | 0.1562 | Much higher for small SMEs |
| Innovation & Collaboration | 0.3189 | 0.1852 | Higher for small SMEs |
| Scalability | 0.2211 | 0.6586 | Opposite direction, mature SMEs more focused on scalability |

Source: Primary Data Analysis (2025)

Brand fit and creativity are the strong-suited of small SMEs, whereas scale-ability is the strong-suited of mature SMEs. This implies difference in strategic orientation (operation vs expansion mindset).

**Table 7. Risk Cluster**

| Sub-Criteria | Group 1 | Group 2 | Observation |
|---|---|---|---|
| Quality Inconsistency | 0.4789 | 0.2928 | Higher for small SMEs |
| Financial Instability | 0.2383 | 0.3501 | Higher for mature SMEs |
| Supply Chain Risk | 0.1990 | 0.2345 | Slightly similar |
| Dependency Risk | 0.0838 | 0.1231 | Close values |

Source: Primary Data Analysis (2025)

Quality rejection is of greater concern to small SMEs whereas financial reliability is to the mature SMEs. The general rankings patterns in the sub-criteria level in both groups show no difference which implies that the logic behind their decision making is similar. Nonetheless, the variations in weight indicate the differences of emphasis: Growing SMEs (below 75M) focus on responsiveness to services, reputation and brand consistency as they have to create reliability and brand reputation. Mature SMEs (>= 75M) are focused on scalability, cost-saving, and financial stability, and are more structured, and efficiency-oriented. Such results in behavior convergence in terms of structure but divergence in terms of emphasis because of the varying capacities to operate and the various strategic focuses.

**Assessment of Differences**

As per comparison analysis, the AHP hierarchy (BCOR) shares the same structure and elicits similar patterns of judgment among the two categories of SMEs. Therefore, two independent models will never help in increasing the complexity of implementation without increasing the accuracy of the decisions. A unified AHP weighting model is taken to the Vendor Management System (VMS) to be useful and ensure generalizability. In order to test the level of uniformity and fluctuation between Group 1 (Growing SMEs) and Group 2 (Mature SMEs), Standard Deviation (SD) of each criterion and sub-criterion was determined. In comparison to difference-based measures, SD gives the insight into the dispersion and stability of the relative importance scores between the two groups. The value of SD (usually below 0.10) when it is low implies the high level of consistency and correspondence of perceptions, whereas the high degree of SD (may be very high) implies the increased variability in the prioritization of particular criteria adopted by each group. This step will enable a further insight into the need whether the weighting actions between the two levels of SMEs maturity are homogenous or are slightly distorted in particular aspects.

The formula below was used to calculate the standard deviation:

$$SD = \sqrt{\frac{\sum(W_i - \bar{W})^2}{n}}$$

where: Wi = weight assigned to each criterion/sub-criterion by each group,
W = average weight across both groups,
n = number of observations (two groups in this case).
The results of the standard deviation analysis are presented in Table 8 below.

**Table 8. Standard Deviation of Criteria and Sub-Criteria amongst SME**

| Criteria / Sub-Criteria | Group 1 (<75M) | Group 2 (>75M) | Average Weight | SD |
|---|---|---|---|---|
| **Benefit** | 0.1686 | 0.0932 | 0.1309 | 0.0533 |
| **Cost** | 0.3679 | 0.5116 | 0.4398 | 0.1016 |
| **Opportunity** | 0.0956 | 0.1001 | 0.0979 | 0.0032 |
| **Risk** | 0.3679 | 0.2948 | 0.3314 | 0.0517 |
| Reputation & Experience | 0.3943 | 0.4875 | 0.4409 | 0.0659 |

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| Criteria / Sub-Criteria | Group 1 (<75M) | Group 2 (>75M) | Average Weight | SD |
|---|---|---|---|---|
| Service Responsiveness & Support | 0.2867 | 0.2085 | 0.2476 | 0.0553 |
| Trust & Relationship | 0.2234 | 0.2085 | 0.2160 | 0.0105 |
| Delivery Performance | 0.0956 | 0.0956 | 0.0956 | 0.0000 |
| Production Cost | 0.7471 | 0.5146 | 0.6309 | 0.1644 |
| Payment Inflexibility | 0.1336 | 0.3879 | 0.2608 | 0.1798 |
| Transaction & Coordination Cost | 0.1194 | 0.0975 | 0.1085 | 0.0155 |
| Brand Alignment | 0.46 | 0.1562 | 0.3081 | 0.2148 |
| Innovation & Collaboration | 0.3189 | 0.1852 | 0.2521 | 0.0945 |
| Scalability Potential | 0.2211 | 0.6586 | 0.4399 | 0.3094 |
| Quality Inconsistency Risk | 0.4789 | 0.2928 | 0.3859 | 0.1316 |
| Financial Instability Risk | 0.2383 | 0.3501 | 0.2942 | 0.0791 |
| Supply Chain & Environmental Risk | 0.199 | 0.2345 | 0.2168 | 0.0251 |
| Dependency Risk | 0.0838 | 0.1231 | 0.1035 | 0.0278 |

Source: Primary Data Analysis (2025)

Groups Note. This table compares the pattern of weighting between Growing SMEs (less than 75M); and Mature SMEs (greater than 75M). The SD below 0.10 implies high consistency whereas SD between 0.10 and 0.15 refers to moderate variability. On the criteria level, SD values of all BCOR factors are lower (< 0.10) besides the one of Cost (0.1016), which demonstrates a moderate range of variability between groups. This suggests that the two groups have a similar line of reasoning on decision making albeit with marginally different focus on cost related issues. There are low-to-moderate deviations at the sub-criteria level, indicating that Growing and Mature SMEs have high compatibility in appraising vendor performance. SDs in Cost and Opportunity clusters are slightly higher, especially the SD in Production Cost (0.1643 Product Cost and Opportunity) (1798) Payment Inflexibility (0.1798), Brand Alignment (0.2148), and Scalability Potential (0.3093) indicate that business maturity has an implication on the SMEs perception of the importance of a vendor. Mature SMEs are also drawn to the options of scalability and flexible payment mechanisms whereas Growing SMEs value affordability and brand fit. Altogether, the SD analysis shows that the differences between both groups are insignificant and fall within the acceptable range, which proves that the AHP model structure can be considered robust and stable, and applicable. Thus, the Vendor Management system (VMS) has a single weighting system because it is an effective system that reflects the general SME priorities without making it complex enough to implement in actual practice.

**Numerical Example of Vendor Evaluation, Purpose of the Numerical Example**
The section involves the provision of a numerical sample to illustrate how the developed AHP based Vendor Evaluation Model was used under the unified framework of BCOR (Benefit, Cost, Opportunity, and Risk). The aim of the object is to analyze and compare three real vendors who are cooperating with or in some ways could be cooperating with Terra/SMEs, a small and medium sized enterprise. The vendors assessed are: Vendor A, Vendor B, Vendor C. The purpose of the analysis is to select the vendor that is the most appropriate to fulfil the

business needs of Terra/SMEs, as well as its long-term business strategic goals, by weighting the quantitative AHP with the qualitative evaluation performed using a structured questionnaire. Table 9 Vendor Comparison Based on BCOR Sub-Criteria.

Before applying the AHP model, the three vendors were assessed qualitatively through a structured questionnaire. The questions were aligned with the BCOR sub-criteria to capture the vendors' real performance in dimensions such as responsiveness, cost efficiency, innovation, and risk control.

### Table 9. Vendor Comparison Based on BCOR Sub-Criteria

| BCOR Factor | Sub-Criteria | Vendor A | Vendor B | Vendor C | Interpretation |
|---|---|---|---|---|---|
| Benefit | Service Responsiveness & Technical Support | Responds within 1–2 days and provides feedback | Similar | Similar | All vendors are highly responsive |
| | Trust & Relationship | No long-term partnership yet | No long-term partnership | Has collaborated >1 year | Vendor C leads |
| | Reputation & Experience | <2 years in operation | 2–5 years | >10 years | Vendor C has the strongest credibility |
| | Delivery Performance | Usually on-time (5–10 days) | Usually on-time (11–15 days) | Usually on-time (11–15 days) | Vendor A slightly faster |
| Cost | Production Cost | IDR 150,000–200,000/unit | <IDR 100,000 | <IDR 100,000 | Vendor B & C more efficient |
| | Coordination & Transaction Cost | No extra cost | No extra cost | No extra cost | All equal |
| | Payment Flexibility | Flexible in payment schedule | Conditional | Conditional | Vendor A more flexible |
| Opportunity | Collaboration & Innovation | Frequently provides input on design | Often | Often | All proactive |
| | Scalability Potential | Can increase capacity easily | Same | Same | All can scale up |
| | Brand Alignment | Understands brand moderately | Understands moderately | Highly aligns with brand identity | Vendor C strongest fit |

| BCOR Factor | Sub-Criteria | Vendor A | Vendor B | Vendor C | Interpretation |
|---|---|---|---|---|---|
| Risk | Quality Inconsistency Risk | Often rework (>10%) | Occasionally (5–10%) | Occasionally (5–10%) | Vendor A riskier |
| | Dependency Risk | Highly dependent on few clients | Moderate | Diversified | Vendor C most stable |
| | Financial Instability Risk | Limited capital | Sufficient capital | Sufficient capital | Vendor A weakest |
| | Supply Chain & Environmental Risk | Sometimes lacks materials | Rarely | Never | Vendor C safest |

Source: Primary Data Collection from Vendor Assessment (2025)

## Local Priority Weights of Vendors

Based on qualitative analysis above, the vendors will be assessed further in Super Decisions software by making pairwise comparison of them. All the sub-criteria of the BCOR model became a node of comparison and resulted in normalized local priorities of Vendors A, B and C.

### Table 10. Local Priorities of Vendor Alternatives

| Main Criteria | Sub-Criteria | Vendor A | Vendor B | Vendor C |
|---|---|---|---|---|
| Benefit | Service Responsiveness & Support | 0.150 | 0.705 | 0.145 |
| | Trust & Relationship | 0.115 | 0.110 | 0.775 |
| | Reputation & Experience | 0.156 | 0.064 | 0.780 |
| | Delivery Performance | 0.145 | 0.710 | 0.145 |
| Cost | Production Cost | 0.468 | 0.067 | 0.465 |
| | Transaction & Coordination Cost | 0.338 | 0.329 | 0.333 |
| | Payment Flexibility | 0.150 | 0.700 | 0.150 |
| Opportunity | Innovation & Collaboration | 0.336 | 0.331 | 0.333 |
| | Scalability Potential | 0.330 | 0.336 | 0.334 |
| | Brand Alignment | 0.329 | 0.334 | 0.337 |
| Risk | Quality Inconsistency Risk | 0.448 | 0.100 | 0.452 |
| | Dependency Risk | 0.112 | 0.108 | 0.780 |
| | Financial Instability Risk | 0.095 | 0.250 | 0.655 |

| Main Criteria | Sub-Criteria | Vendor A | Vendor B | Vendor C |
|---|---|---|---|---|
| | Supply Chain & Environmental Risk | 0.245 | 0.090 | 0.665 |

Source: Super Decisions Software Output (2025)

(All consistency ratios were < 0.10, indicating acceptable consistency.)

## Aggregation of Global Weights

The various sub-criteria were multiplied with respective global weight in the unified model (see Section 4.3.3). The global score of each vendor was calculated by SuperDecision as follows:

The final global weights and vendor rankings generated from the system are summarized below (Table 11).

### Table 11. Global Weighted Scores and Ranking

| Vendor | Global Score | Normalized Priority | Rank |
|---|---|---|---|
| Vendor A | 0.0958 | 0.287 | 2 |
| Vendor B | 0.0658 | 0.197 | 3 |
| Vendor C | 0.1717 | 0.515 | 1 |

Source: Super Decisions Software Output (2025)

## Discussion of Results

The identified AHP synthesis results show that Vendor C is the best vendor to do joint production with Terra with a normalized score of 0.515 which is very high compared with Vendor A (0.287) and Vendor B (0.197). Key insights include Vendor C has gained excellence in Reputation, Experience, Quality Consistency, and Brand Alignment which is in line with the long term vision of consistent reliable scaled syari fashion production of Terra. Vendor A demonstrates the Cost Efficiency and Flexibility to Pay as competitive advantages, which makes it an appropriate choice in terms of small-article or in a hurry projects. Vendor B is also cost-effective but has a lower relationship continuity and operational risk management.

These results confirm the objectivity of AHP model in distinguishing vendors in both quantitative and qualitative criteria within the framework of the BCOR.
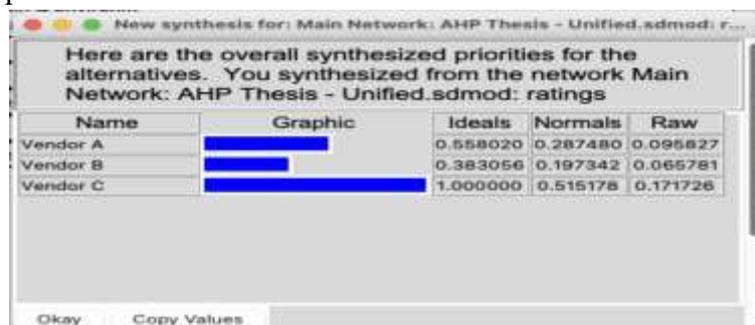


**Figure 2. Comparison of Vendor Global Weights (AHP Synthesis)**
Source: Super Decisions Software Output (2025)

Figure 2 presents the results of the final AHP synthesis in the comparison of the three vendors. The priority score of Vendor C was the largest normalized (0.515), then Vendor A (0.287) and Vendor B (0.197). The chart substantiates the notion that Vendor C is the best vendor that would collaborate with SME in the production of fashion. The presented numerical example shows that the unified AHP BCOR model could be effectively implemented to select the vendor in fashion SMEs. Qualitative perceptions (that are captured by the questionnaire) are combined with the quantitative prioritization (that is carried out through the computation of AHP), which will lead to clear and defendable decision-making. Finally, the vendor C is selected as the most effective one, as its abilities would have been the least risk minimization, as well as the consistency in quality and brand alignment.

**Sensitivity Analysis**

The sensitivity analysis was aimed at investigating how robust the developed AHP-based Vendor Evaluation Model is with the variations in the relative importance of criteria and sub-criteria. This action will help maintain the same ranking of the vendors in varied situations when making the decision by the decision-makers. The analysis has been done in the Super Decisions software and sensitivity plots have been drawn in Figures 4.14 to 4.18. In all figures, the lines of Vendor A, Vendor B, and Vendor C only have slight differences in the slope meaning that the ranking of alternatives is very stable despite changes in the weights of a criterion. The normalized priority score of Vendor C is continually highest followed by that of Vendor A and Vendor B indicating that the result of the model is not very sensitive to moderate changes in preference.

**Main Criteria Sensitivity**
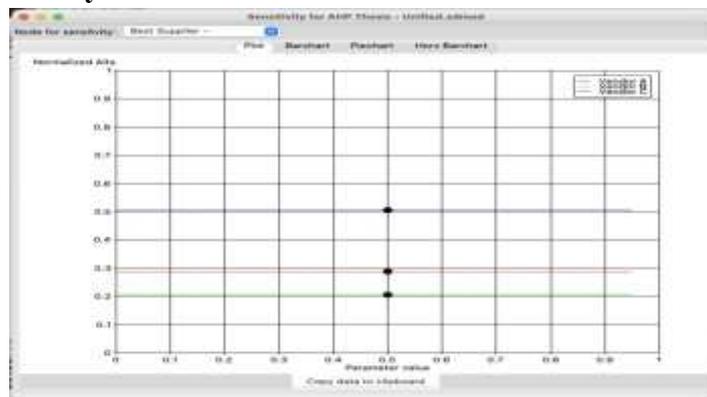


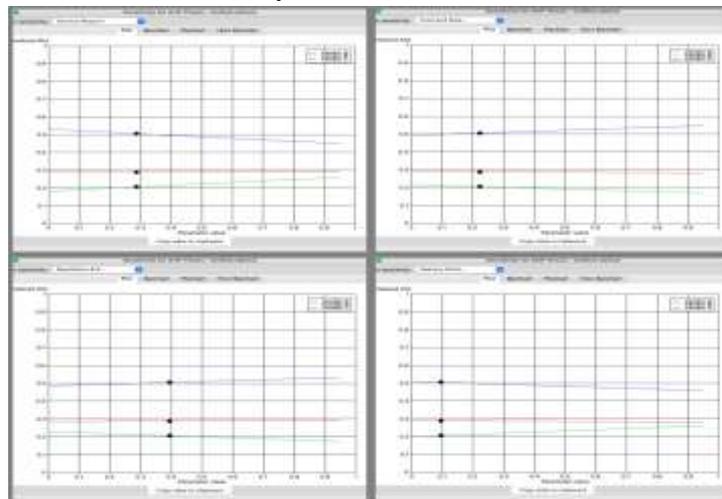**Figure 3. Main criteria Sensitivity Analysis (BCOR)**
Source: Super Decisions Software Output (2025)

This figure shows the impact of differing the weight of the four most important criteria which are Benefits, Costs, Opportunities, and Risks, on the rankings of vendors. Vendor C is the most normalized one in all the criteria, which means that the ultimate decision is truly resistant to the alteration of the top-level preferences. The BCOR-level analysis indicates four sensitivity curves, which relate to Benefits, Costs, Opportunities and the Risk. Vendor C is seen to be dominant across all the weights, ranges of 0 - 1, with a level of strength in the quality of services and responsiveness under Benefits. At Costs, a slight negative movement of Vendor C is observed with the rise in the importance of costs, although there is no change in the ranking. There are nearly no vendors, and opportunities are almost linearly displayed, thus there are few

differences in terms of dimensions influencing the ranking of stability. In the case of Risks, the performance of Vendor C even gets better with the risk weight, which proves its dependability and stability on production. According to these findings, the vendor selection process in general is robust regarding the key BCOR dimensions.

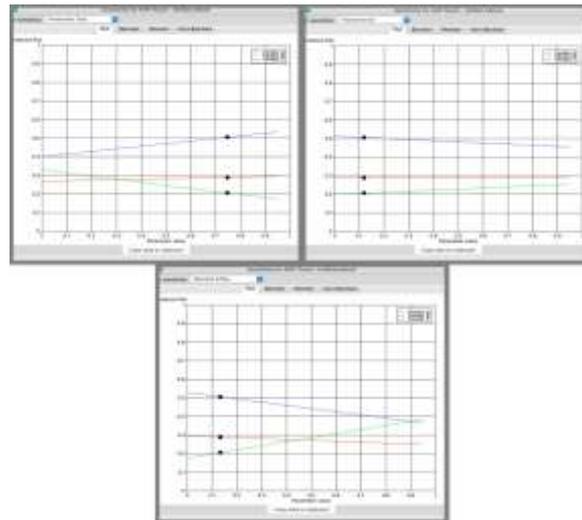**Sub-Criteria Sensitivity**

    1. Benefits Sub-Criteria Sensitivity



**Figure 4. Benefit Sub-Criteria Sensitivity Analysis.**
Source: Super Decisions Software Output (2025)

The plots show sensitivity within the four Benefit sub-criteria Service Responsiveness, Trust and relationship, Reputation and experience, and Delivery performance. The slopes are almost flat among all vendors indicating that variations in those factors will not switch the final ranking, Vendor C is the best. Service Responsiveness, Trust and relationship, reputation and experience, the Benefit sub-criteria reveal that Vendor C is the vendor of choice under all the cases. The slopes are almost horizontal that means that even when the decision-makers shift their focus between the following factors, the order regarding the vendors will be the same. This indicates that the good performance of the chosen vendor is its consistency in delivering the services of high quality and reliability performance.

    2. Costs Sub-Criteria Sensitivity

Developing Vendor Evaluation Model for Third-Party Manufacturing: Vendor Management System in SMEs Fashion Industries
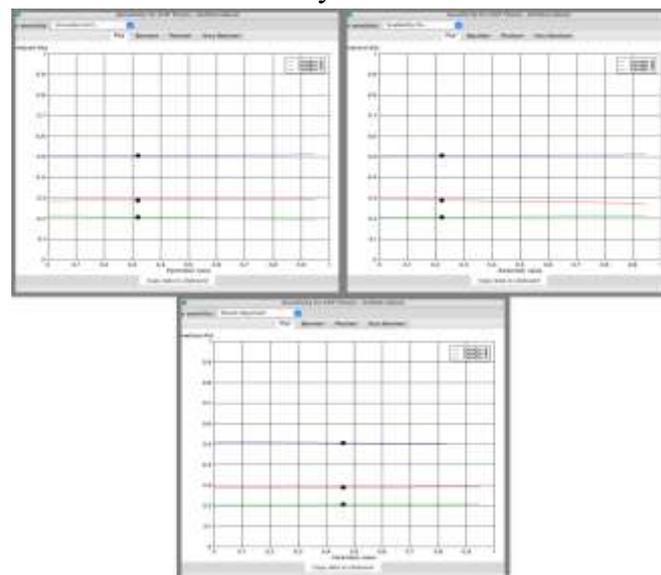


**Figure 5. Sensitivity Analysis of Cost Sub-Criteria**
Source: Super Decisions Software Output (2025)

This value displays the sensitivity behavior of Production Cost, Coordination and transaction and Payment Inflexibility. Vendor C exhibits slight downward trend because its cost relevance goes up but retains its centralization concerning the being overall which validates stability of model in cost related variations. In the case of the Cost sub-criteria, the Production Cost, Coordination and transaction, and payment Inflexibility, a marginally high sensitivity is found in comparison to Benefits. In both Payment Inflexibility and Production Cost, Vendor B and Vendor A increase and decrease correspondingly, but there is no reversal of rank. The vendor C remains the leading one as it is efficient even despite the variation in other cost-related aspects.

3. Opportunities Sub-Criteria Sensitivity



**Figure 6. Opportunity Sub-Criteria Sensitivity Analysis**
Source: Super Decisions Software Output (2025)

The graphs show the impacts of adjusting relative weight of Innovation and Collaboration, Brand Alignment and Scalability Potential. The lines of the vendors are almost parallel, showing that growth-oriented factors have little effect on the ranking changes. Opportunity sub-criteria, Innovation & Collaboration, Brand Alignment, and Scalability Potential have nearly parallel lines across all vendors. This confirms that these growth-oriented areas do not determine much on the ultimate ranking. Vendor C has a maintained high normalized score, which means that it has a high proliferative capability and ability to stick to the fashion SME brand vision.

    4. Risk Sub-Criteria Sensitivity
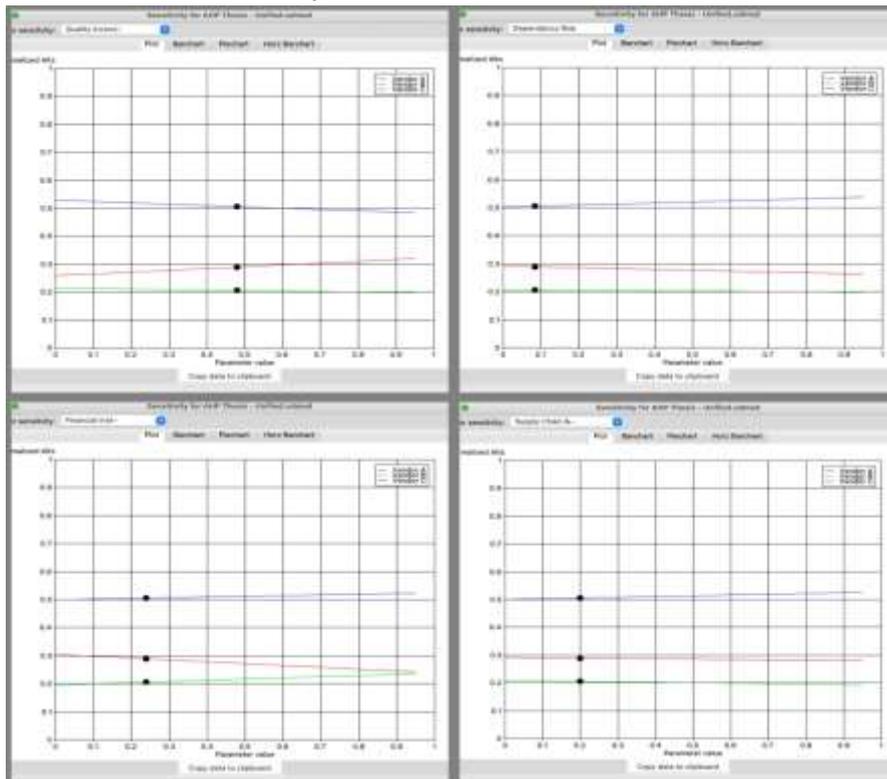


**Figure 7. Risk Sub-Criteria Sensitivity Test**
Source: Super Decisions Software Output (2025)

The values of this figure depict how the vendor rankings respond to changes in quality inconsistencies and dependency risk as well as financial instability and supply chain risk. The performance of vendor C increases slightly with the increase in risk importance and highlights its robustness and stability in the uncertain environment in terms of its operations. The results under the Risk dimension -Quality Inconsistency, Dependency Risk, Financial Instability and Supply Chain Risk are again characterized by stable curves. The slope of vendor C gently increases when the weight to risk factors makes its resiliency to the operational and financial uncertainties makes its comparative advantage stronger. The curves of Vendor A and B are almost flat and never intersect which signifies lack of rank reversal.

    5. Conclusion of Sensitivity Analysis

The sensitivity analysis that has been developed and integrated together shows that the formulated AHP model is robust, consistent, and reliable. Vendor C is also the highest rated vendor in all of the tested situations and there are no cross over points between curves of the

vendor in any figure. This affirms that even with different managerial interests, the unified vendor assessment model offers the consistent decision support in choosing the third-party manufacturers in the syar'i fashion SME situation.

## CONCLUSION

This study successfully developed an AHP-based Vendor Management System (VMS) integrating the BOCR framework (Benefits, Opportunities, Costs, and Risks) to support structured and objective vendor selection for Terra and similar SMEs in the syar'i fashion industry. The model demonstrated strong reliability, consistently identifying Vendor C as the optimal choice across all tested scenarios due to its superior performance in service responsiveness, delivery capability, production flexibility, and risk management. Sensitivity analysis further confirmed the model's stability, as no rank reversal occurred even when criteria weights were adjusted, establishing it as a dependable decision-support tool for addressing the high reject rates that characterize poor vendor management in fashion SMEs. Future research could expand the applicability of this model by incorporating a larger and more diverse sample of SMEs across different fashion segments and regional contexts in Indonesia, as well as exploring the integration of real-time performance data and digital vendor monitoring systems to enhance the model's responsiveness and scalability in dynamic supply chain environments.

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