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Techno-Economic Analysis of Supplier and Shipping Service Selection to Reduce Cost of Goods Sold (Study Case SME XYZ)

Analisis Tekno-Ekonomi Pemilihan Pemasok dan Jasa Pengiriman untuk Menurunkan Harga Pokok Penjualan (Studi Kasus UKM XYZ)

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ABSTRACT
Indonesia's creative industry, primarily craft, fashion, and culinary, contributes to the country's GDP by 15% annually, with projections estimating it to reach IDR 1,100 trillion by 2020. This growth intensifies industry competition, prompting business owners to compete vigorously to boost sales. SME XYZ wants to implement a cost leadership strategy; businesses must reduce costs, especially in logistics distribution, by reducing operational costs. This study examines the techno-economic analysis of supplier and shipping service selection to reduce the Cost of Goods Sold (COGS) for SME XYZ, a company operating in Indonesia's competitive fashion industry. The research highlights the significant contribution of the creative industry to Indonesia's GDP and the critical role of logistics in maintaining competitive pricing. By employing Total Cost Analysis (TCA), the study evaluates various supplier and transportation combinations, focusing on reducing operational costs while enhancing supply chain efficiency. Field studies and literature reviews provided data on suppliers from Bandung, Jogja, and Malang and logistics services, including JTR, Baraka, and Adex. Results indicate that the optimal combination—Supplier A (Bandung) and Expedition B (Baraka)—reduces COGS from IDR 105.200 to IDR 98.200. The findings offer SME XYZ strategic insights for implementing a cost leadership strategy, ensuring improved operational efficiency and competitive market positioning.
Keywords: *Techno-Economic Analysis (TEA), Cost of Goods Sold (COGS) Optimization, Supplier and Logistics Selection, SME Supply Chain Management*

ABSTRAK
Industri kreatif Indonesia, terutama kerajinan, fesyen, dan kuliner, berkontribusi terhadap PDB negara sebesar Industri kreatif Indonesia, terutama kerajinan, fesyen, dan kuliner, berkontribusi terhadap PDB negara sebesar 15% per tahun, dengan proyeksi yang diperkirakan akan mencapai IDR1.100 triliun pada tahun 2020. Pertumbuhan ini meningkatkan persaingan industri, sehingga mendorong pemilik bisnis untuk bersaing secara ketat untuk meningkatkan penjualan. UKM XYZ ingin menerapkan strategi kepemimpinan biaya; bisnis harus mengurangi biaya, terutama dalam distribusi logistik, dengan mengurangi biaya operasional. Penelitian ini mengkaji analisis tekno-ekonomi pemilihan pemasok dan jasa pengiriman untuk mengurangi Harga Pokok Penjualan (HPP) UKM XYZ, sebuah perusahaan yang beroperasi di industri fesyen yang kompetitif di Indonesia. Penelitian ini menyoroti kontribusi signifikan industri kreatif terhadap PDB Indonesia dan peran penting logistik dalam mempertahankan harga yang kompetitif. Dengan menggunakan Total Cost Analysis (TCA), penelitian ini mengevaluasi berbagai kombinasi pemasok dan transportasi, dengan fokus pada pengurangan biaya operasional sekaligus meningkatkan efisiensi rantai pasokan. Studi lapangan dan tinjauan literatur memberikan data tentang pemasok dari Bandung, Jogja, dan Malang serta layanan logistik, termasuk JTR, Baraka, dan Adex. Hasil penelitian menunjukkan bahwa kombinasi optimal-Pemasok A (Bandung) dan Ekspedisi B (Baraka)-mengurangi HPP dari IDR 105.200 menjadi IDR 98.200. Temuan ini memberikan wawasan strategis bagi UKM XYZ untuk menerapkan strategi kepemimpinan biaya, memastikan peningkatan efisiensi operasional dan posisi pasar yang kompetitif.
Kata kunci: Analisis Tekno-Ekonomi (TEA), Optimalisasi Harga Pokok Penjualan (HPP), Pemilihan Pemasok dan Logistik, Manajemen Rantai Pasokan UKM

1. Introduction

The creative industry subsector in Indonesia, primarily encompassing craft, fashion, and culinary, significantly contributes to the country's GDP, surpassing other subsectors, with factors such as workforce, employee wages, and patents also playing a pivotal role (Burhanudin et al.,

2020). The creative industry in Indonesia contributes to GDP growth by 15% annually, with projections estimating it to reach IDR 1,100 trillion by 2020 (Sukarmi, 2020). This increasing contribution intensifies industry competition, prompting business owners to compete vigorously to boost sales The more companies that offer products and services, the more choices consumers have, thus increasing consumer bargaining power (Suranto & Riza, 2005). Heightened competition in product markets leads to suppliers relocating closer to customers, thereby improving sales and customer relationships, yet adversely affecting creative innovation, which is essential for growth (Chen et al., 2020). To increase these sales, business owners attempt to lower the price of their products in the market as part of implementing a cost leadership strategy (Azad et al., 2012). However, this strategy poses challenges for business owners as it impacts their overall business performance. A business entity must conduct its activities effectively and efficiently in facing competition. Enhancing the efficiency of enterprise activities is crucial for thriving and evolving in today's fiercely competitive business landscape (Nikitina, 2023). Business entities need to reduce costs, especially in logistics distribution, by reducing operational costs so that companies can reduce the cost of production to implement a cost leadership strategy. Implementing a more efficient logistics system is essential to achieve these cost reductions. A streamlined logistics system can significantly save transportation and storage, ensuring timely delivery and reducing waste. This lowers operational costs and enhances customer satisfaction by ensuring that products are readily available and delivered promptly (Szczepański et al., 2020). Moreover, advanced logistics solutions, such as automated warehousing and optimized routing, can further reduce overhead and improve the overall efficiency of supply chain management.

Small and Medium Enterprises (SMEs) are pivotal in driving domestic and international economic growth. They significantly contribute to employment, innovation, and the overall dynamism of the economy (Batrancea, 2022). In today's highly competitive business environment, adopting the right strategies is essential for the survival and growth of SMEs (Gamage et al., 2020). One effective strategy SMEs can employ to gain a competitive edge is cost leadership. This approach reduces costs across various elements, such as raw materials, logistics, and marketing expenses (Haque et al., 2021; Hossain et al., 2023). Logistics costs substantially impact overall expenditure, often representing a significant portion of total costs. Efficient logistics management can lead to considerable cost savings, enhance operational efficiency, and improve customer satisfaction by ensuring timely delivery and reducing waste (Hoffman et al., 2014; Kučera, 2017). Implementing an optimized logistics system is thus crucial for SMEs aiming to minimize expenses and maximize profitability (Karyotis et al., 2022). This research seeks to implement cost leadership by reducing product costs by creating alternative distribution channels. SMEs can reduce procurement costs and improve their supply chain efficiency by identifying and partnering with suppliers offering the most profitable alternatives. Additionally, conducting a techno-economic analysis is essential to evaluate the viability and economic benefits of implementing these advanced logistics systems. This analysis analysis can help identify the most cost-effective solutions for reducing costs. This involves evaluating the technical and economic feasibility of different options and selecting the one that offers the best value for money (Dadkhah et al., 2022).

Previous research on techno-economic analysis for reducing logistics costs in small and medium-sized enterprises (SMEs) has focused on various strategies and technologies to optimize logistics operations and minimize expenses. Here are some key findings and insights from the provided sources. Techno-economic analysis (TEA) helps identify cost bottlenecks and potential research priorities, allowing for cost-effective logistics (Scown et al., 2021). TEA has been used to identify cost-saving opportunities in logistics, such as optimizing production and distribution processes, reducing waste, and improving logistics (Andretti et al., 2018). Then there is also research that discusses reducing the cost of raw materials from suppliers, but the discussion is

more towards how to make costs efficient with lot sizing (Djunaidi et al., 2019). Building on these insights, this research will specifically examine the application of TEA in SME XYZ's logistics operations to uncover areas for cost reduction and operational enhancements.

SME XYZ operates within the highly competitive fashion industry, specifically focusing on producing and selling backpacks and wallets. These products are offered in various materials, colours, and designs, catering to a diverse consumer base. Sales are primarily conducted through online marketplaces, where intense price competition necessitates strategic cost management. This competitive environment compels business owners to seek cost reductions, particularly in the logistics sector, which encompasses the distribution and procurement of goods. SME XYZ collaborates with multiple suppliers in different regions to manage its inventory. The primary suppliers are based in Yogyakarta (Jogja) and Bandung, with the addition of a new supplier from Malang. This geographical diversification of suppliers provides SME XYZ with various sourcing options, potentially enhancing supply chain resilience and flexibility. However, it also introduces complexity in logistics management, as coordinating procurement and distribution from multiple locations can lead to increased costs and operational challenges. The imperative to reduce logistics costs stems from the need to maintain competitive pricing while ensuring the timely and efficient delivery of products. This research seeks to implement a cost leadership strategy through techno-economic analysis to identify the most cost-effective suppliers and distribution channels. SME XYZ aims to achieve cost leadership by optimizing supplier selection and shipping services, thereby improving its competitive position in the marketplace.

Indonesia's creative industries, especially in the handicraft, fashion, and culinary sectors, greatly boost the country's GDP and create employment opportunities, but they also face fierce competition, necessitating cost-cutting measures, particularly in the logistics sector. SMEs, which are crucial for accelerating economic growth, need to use practical tactics like cost leadership to stay in business and prosper. This entails cutting expenses on a number of fronts, including marketing, transportation, and raw materials. SMEs must put in place an efficient logistics system in order to cut expenses and increase revenue. Finding cost-effective solutions requires doing a techno-economic analysis (TEA). Prior studies have demonstrated that TEA enhances efficiency, reduces costs, and optimizes logistics operations. In order to keep prices competitive, SME XYZ, which works in the cutthroat fashion sector, needs to lower its logistical expenses. SME XYZ aims to reduce the Costs of Goods Sold (COGS) and enhance its competitive position in the market by working with suppliers from various regions and optimizing supplier selection and shipping services through techno-economic analysis in order to implement a cost leadership strategy. To ensure that the most economical logistics solutions are used, total cost analysis, or TCA, will be essential in assessing all costs related to logistics decisions, such as handling, transportation, and administrative costs.

2. Literature Review

This chapter provides a review of the literature on the methods and approaches that will be applied when performing techno-economic analysis to optimize supplier selection and service delivery. The study's main subject is total cost analysis (TCA). The goal is to determine the most economical logistics techniques that small and medium-sized businesses (SMEs) can use to lower their cost of goods sold (COGS).

2.1 Total Cost Analysis (TCA)

TCA evaluates all relevant costs associated with logistics decisions, including direct and indirect costs. Unlike traditional methods that focus only on the purchase price, TCA considers additional costs such as shipping, handling, and administrative costs. This method's approach provides a clearer picture of how the total cost of different shipping cost options stack up. (Sendek-Matysiak et al., 2022).

2.2 Application of TCA in Supplier Selection

Supplier selection is crucial for supply chain efficiency. Traditional criteria include price, quality, and delivery performance. TCA enhances this process by evaluating the total costs associated with each supplier, leading to more informed decisions that balance cost and performance (Silva & Freires, 2020). By considering all cost factors, businesses can identify suppliers that offer the best overall value.

TCA also aids in comparing different transportation options to find the most cost-effective solution (D'Acierno et al., 2022). The entire cost of logistics is heavily impacted by shipping costs, which are determined by a number of factors such as distance, the cost per kilogram of expedition services, and other costs. Transportation costs increase with distance because of higher fuel consumption and longer travel times. It is necessary to compare the prices of various expedition services in order to choose the most economical option because these services have different weight-based rates. The total cost of transportation also includes other costs like insurance, handling fees, and additional surcharges levied by the shipping company.

2.3 Cost of Goods Sold (COGS)

Cost of Goods Sold (COGS) is a crucial financial metric that represents the direct costs associated with producing and selling a company's products or services (Purnamasari et al., 2022). It includes the costs of raw materials, labor, and overhead expenses directly related to the production process. COGS is an essential component of a company's income statement and is used to calculate gross profit and net income.

3. Research Method

The purpose of this study is to conduct a techno-economic analysis of the logistics system's selection of suppliers and shipping services for goods procurement in SME XYZ. The first step is to identify existing problems within SME XYZ, beginning with an assessment of partner-owned suppliers and current shipping services. A thorough literature review is carried out, gathering theoretical data and materials from credible sources such as Scopus, Google Scholar, and ScienceDirect. Field studies are then conducted directly at SME XYZ, including interviews with business owners to gain direct insight. The data for this study came from a review of the literature on techno-economic analysis as well as field studies.

The following phase is data collection, during which company profiles, supplier information, and the shipping services that SME XYZ uses are among the details that are gathered from field research and literature. The next step in the data processing process is to use Total Cost Analysis (TCA) to calculate and process the gathered data. TCA is a decision-making process that takes into account all pertinent costs, not just the upfront or obvious ones. To make sure that all costs are taken into account when making decisions, this technique is widely used in supply chain management and logistics. In order to identify the most economical choice, this study compares the overall costs of several supplier and shipping combinations using TCA. The procedure entails figuring out every relevant expenses, like material and shipping, and summing them up to find the overall cost per unit for each option. The study attempts to determine the supplier and shipping combination that minimizes the cost of goods sold (COGS) for SME XYZ by comparing the total costs of all options objectively.

The next stage is to evaluate and choose the best alternative solution after the computations are finished. For SME XYZ, the suggested option with the lowest overall cost will be the best option. For SME XYZ, the study's findings can be a strategic consideration in improving the effectiveness of their procurement and logistics processes. Furthermore, SME XYZ may be able to save a substantial amount of money and increase their operational effectiveness by putting these findings into practice, which will help them stay competitive in a competitive marketplace. The study's methodology is shown in Figure 1.

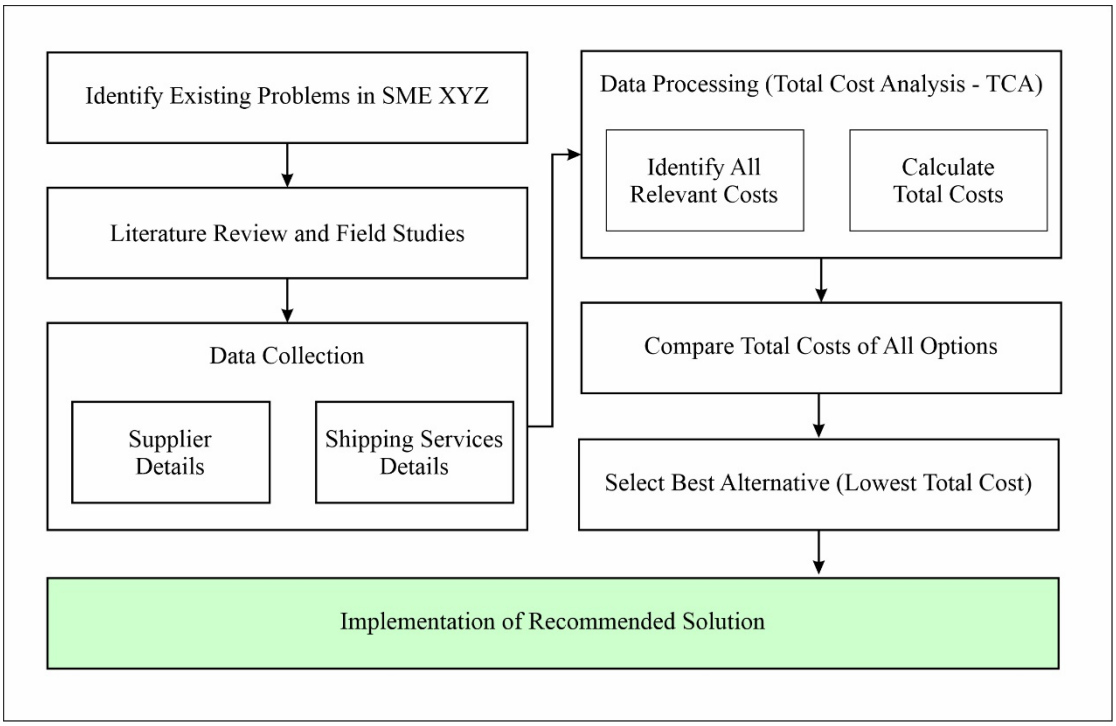

Fig. 1. Research Method Flowchart

4. Result and Discussion

This section details the research's findings, which include identifying the problems that currently exist, gathering data, identifying all pertinent costs, figuring out the overall cost, identifying alternatives, analyzing those alternatives, and choosing the best one.

Problem Identification

In conducting its business activities, SME XYZ collaborates with suppliers from three cities: Bandung, Jogja, and Malang. These suppliers offer different manufacturing costs for their products. Bandung, renowned as a fashion-producing city in Indonesia, offers the lowest manufacturing prices. Malang follows with moderate costs, while Jogja has the highest manufacturing costs. To facilitate this research, the author assigns labels to each supplier: Supplier A for Bandung, Supplier B for Malang, and Supplier C for Jogja. For logistics, SME XYZ partners with various expedition services: JTR (labeled Ex A), Baraka (labeled Ex B), and Adex (labeled Ex C). Typically, each shipment weighs 45 kilograms, equivalent to 100 products. Initially, SME XYZ relied solely on a supplier from Jogja and used the JTR expedition service, without analyzing other potential logistics combinations that might reduce costs. The initial COGS was IDR 104,500. This research aims to determine the most cost-effective combination of suppliers and shipping methods to minimize COGS.

Data Collection

This stage involves gathering all necessary data from both the literature review and field studies. The data collection is divided into two main categories, Supplier Details and Shipping Services Details.

Supplier Details:

This section includes comprehensive profiles and cost information from three main suppliers in Bandung, Jogjakarta, and Malang. The research focuses on a single finished product, a backpack made from CPE canvas. This product's Bill of Material (BOM) is categorized into three main parts: the bag body part, the front pocket section, and the carry strap. Each part comprises CPE canvas fabric, foam, zippers, and straps. Below is the detailed BOM:

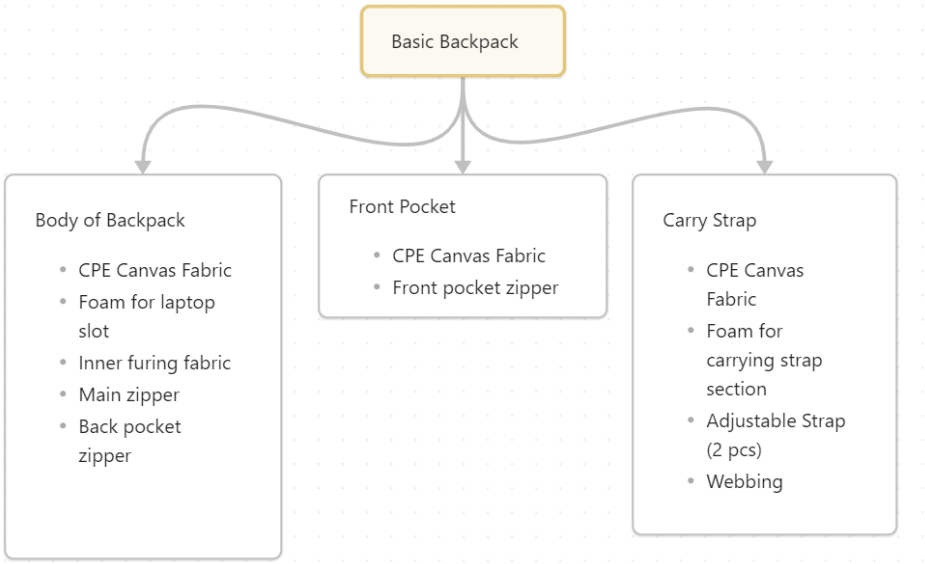

Fig. 2 Bill of Material

While table 1 below is an explanation of how the production price for each supplier is based on the materials used in manufacturing and the cost of sewing services for one piece of bag.

Table 1. Production Cost Each Supplier

Item	Supplier A	Supplier B	Supplier C
CPE Canvas Fabric	IDR 28.500	IDR 31.500	IDR 31.500
Foam for laptop slot	IDR 6.500	IDR 6.500	IDR 6.000
Inner furing fabric	IDR 4.500	IDR 4.000	IDR 4.500
Main zipper	IDR 8.000	IDR 10.000	IDR 8.000
Back pocket zipper	IDR 4.000	IDR 5.000	IDR 4.000
Front pocket zipper	IDR 4.000	IDR 5.000	IDR 4.000
Foam for the carrying strap section	IDR 4.000	IDR 4.500	IDR 4.000
Webbing strap	IDR 7.500	IDR 8.000	IDR 8.000
Adjustable Strap (2 pcs)	IDR 6.000	IDR 7.000	IDR 6.000
Packaging Cost	IDR 3.000	IDR 3.000	IDR 3.000
Sewing fee	IDR 20.000	IDR 18.000	IDR 20.000
Total COGS	**IDR 96.000**	**IDR 102.500**	**IDR 99.000**

These tables summarize the Bill of Material and cost details for each supplier. The total cost of goods sold (COGS) for producing one backpack is calculated for suppliers in Bandung, Jogjakarta, and Malang. Bandung offers the lowest COGS at IDR 96.000, followed by Malang at IDR 99.000, and Jogjakarta at IDR 102.500.

Shipping Services Details

This section includes information about the various freight forwarding services used by SME XYZ, namely Ex A, Ex B, and Ex C. Each service has different pricing structures and performance metrics, impacting the total shipping costs. Factors affecting these costs include distance, price per kilogram from expedition services, and other expenses such as toll fees, handling charges, and insurance. Below are the prices for these freight forwarders for shipping to Surakarta from various departure locations:

- **Ex A (Data taken on June 1, 2024)**
    - Bandung --> Surakarta
        - First 10 Kg: IDR 50.000
        - Additional charge per Kg after goods exceed 10 Kg: IDR 5.000
    - Malang --> Surakarta
        - First 10 Kg: IDR 60.000
        - Additional charge per Kg after goods exceed 10 Kg: IDR 6.000
    - Yogyakarta --> Surakarta
        - First 10 Kg: IDR 45.000
        - Additional charge per Kg after goods exceed 10 Kg: IDR 4.500
- **Ex B (Data taken on June 1, 2024)**
    - Bandung --> Surakarta
        - First 1 Kg: IDR 20.000
        - Additional charge per Kg after goods exceed 1 Kg: IDR 2.000
        - Additional charge per Kg after goods exceed 10 Kg: IDR 3.000
        - Handling fee: IDR 10.000
    - Malang --> Surakarta
        - First 1 Kg: IDR 20.000

        - Additional charge per Kg after goods exceed 1 Kg: IDR 1.000
        - Additional charge per Kg after goods exceed 10 Kg: IDR 2.000
        - Handling fee: IDR 10.000
    - Yogyakarta --> Surakarta
        - First 1 Kg: IDR 20.000
        - Additional charge per Kg after goods exceed 1 Kg: IDR 1.000
        - Additional charge per Kg after goods exceed 10 Kg: IDR 2.000
        - Handling fee: IDR 10.000
- **Ex C (Data taken on June 1, 2024)**
    - Bandung --> Surakarta
        - First 10 Kg: IDR 55.000
        - Additional charge per Kg after goods exceed 10 Kg: IDR 5.500
    - Malang --> Surakarta
        - First 10 Kg: IDR 55.000
        - Additional charge per Kg after goods exceed 10 Kg: IDR 5.500
    - Yogyakarta --> Surakarta
        - First 10 Kg: IDR 35.000
        - Additional charge per Kg after goods exceed 10 Kg: IDR 3.000

Shipping expenses are calculated for this study using a single shipment of 100 items, each weighing 490 grams. So the total weight of 100 items is 49 kg. The following formula is used to determine each service provider's shipping cost:

Ex A:

- Bandung to Surakarta: 50.000 + (39 * 5.000) = IDR 245.000
- Malang to Surakarta: 60.000 + (39 * 6.000) = IDR 294.000
- Yogyakarta to Surakarta: 45.000 + (39 * 4.500) = IDR 220.500

Ex B:

- Bandung to Surakarta: 20.000 + (9 * 2.000) + (39 * 3.000) + 10.000 = IDR 167.000
- Malang to Surakarta: 20.000 + (9 * 1.000) + (39 * 2.000) + 10.000 = IDR 117.000

- Yogyakarta to Surakarta: 20.000 + (9 * 1.000) + (39 * 2.000) + 10.000 = IDR 117,000

Ex C:

- Bandung to Surakarta: 55.000 + (39 * 5.500) = IDR 270,500
- Malang to Surakarta: 55.000 + (39 * 5.500) = IDR 270,500
- Yogyakarta to Surakarta: 35.000 + (39 * 3.000) = IDR 152,000

Determining Alternative

When selecting suppliers and expeditions, evaluating and considering alternative combinations of the available options is crucial. The primary criteria for this selection are based on achieving the lowest possible cost, which will result in the lowest cost of goods sold (COGS) for the product. Determining the optimal combination involves a thorough analysis of both supplier costs and transportation costs. The goal is to identify the combination that offers the best overall value, balancing the cost of materials with the cost of shipping.

For instance, one possible combination might involve selecting supplier A, who offers materials at a lower price, and pairing this with expedition service C, which provides the most cost-effective shipping rates. Figure 2 below explains the alternative selection scheme. By systematically analyzing different combinations of suppliers and expeditions, SME XYZ can pinpoint the most efficient and economical option. This strategic approach ensures that all factors are considered, and the selected combination yields the lowest total COGS, ultimately enhancing the company's competitive edge in the marketplace. The process involves:

1. Listing all potential suppliers along with their material costs.
2. Evaluating all available expedition services and their respective shipping rates.
3. Creating possible combinations of each supplier with each expedition service.
4. Calculating the total COGS for each combination.
5. Comparing the total COGS across all combinations to determine the most cost-effective option.

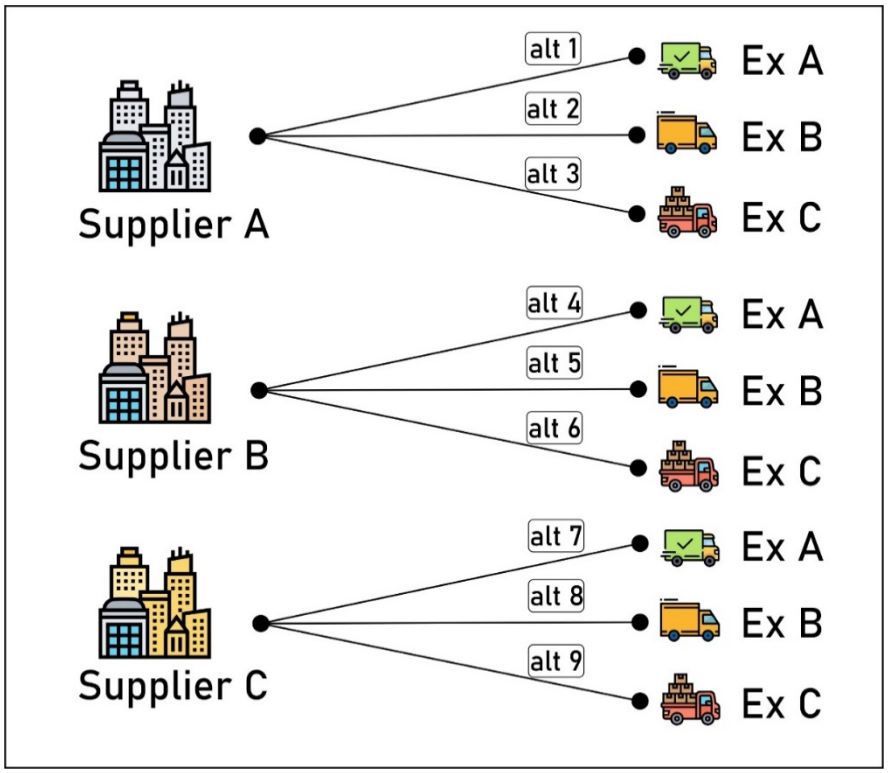

Fig. 3. Determining Alternatives

Alternatives Analysis and Selection Best Alternative

To determine the total cost of goods sold (COGS) for each supplier, we need to add the supplier costs to the transportation costs from each supplier location to Surakarta. With this election, SMEs can lower their selling prices so they can implement a cost leadership strategy. A complete explanation regarding alternative analysis can be seen in the table below. Bandung offers the lowest COGS at IDR 96.000, followed by Malang at IDR 99.000, and Jogjakarta at IDR 102.500.

Table 2. Alternatives Analysis

Alternatif	COGS before shipping	Shipping Cost (45Kg)	Shipping Cost/pcs	Final COGS
1	IDR 96.000	IDR 245.000	IDR 2.450	IDR 98.450
2	IDR 96.000	IDR 294.000	IDR 2.940	IDR 98.940
3	IDR 96.000	IDR 220.500	IDR 2.205	IDR 98.205
4	IDR 99.000	IDR 167.000	IDR 1.670	IDR 100.670
5	IDR 99.000	IDR 117.000	IDR 1.170	IDR 100.170
6	IDR 99.000	IDR 117.000	IDR 1.170	IDR 100.170
7	IDR 102.500	IDR 270.500	IDR 2.705	IDR 105.205
8	IDR 102.500	IDR 270.500	IDR 2.705	IDR 105.205
9	IDR 102.500	IDR 152.000	IDR 1.520	IDR 104.020

Based on the table above, it can be concluded that the chosen alternative is alternative 3 which has the lowest COGS, which is IDR. 98,205.

5.Conclusions

This research can be concluded that the importance of a systematic and data-driven approach in selecting suppliers and transportation services to minimize the cost of goods sold (COGS) for SME XYZ. By conducting a techno-economic analysis (TEA), this study identified the most cost-effective combination of suppliers and delivery options. At the analysis stage it was explained that, despite higher transportation costs, sourcing materials from suppliers in Bandung resulted in the lowest overall COGS due to lower material costs.

Evaluating various combinations of suppliers and freight shows that a careful assessment of material and transportation costs is critical to achieving cost efficiency. This research underscores that optimizing the logistics system can result in cost savings, improving the company's competitive position in a highly competitive market. Applying the findings from this study enables SME XYZ to adopt a cost leadership strategy, ultimately reducing operational costs, increasing profitability, and ensuring sustainable growth in the long term.

6. Limitation

Scope of Suppliers and Expeditions : This research only considers three suppliers and three expedition services. Including a wider range of suppliers and shipping options could provide a more comprehensive analysis and potentially reveal additional cost-saving opportunities.

Single Product Focus: The study focuses solely on one type of finished product, a backpack made from CPE canvas. The findings may not be directly applicable to other products with different materials, designs, or production requirements.
Static Pricing: The research assumes static prices for both materials and shipping rates based on the data collected at a specific time. Market fluctuations and seasonal variations could affect these prices, and dynamic pricing models may be necessary for a more accurate analysis.

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