



# Sustainability-Driven Supplier Performance in the Sea Cucumber Business

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**Abstract.** This study aims to assess supplier performance within the context of business sustainability, with a particular focus on the dried sea cucumber supply chain at CV. Air Maritim Nusantara. A quantitative approach was employed, incorporating document analysis, surveys, and interviews with key stakeholders in the supply chain. Supplier performance was evaluated using the Fuzzy TOPSIS method, which accounts for uncertainty in performance data by applying relative weights to various indicators, such as delivery timeliness, product availability, quality, and responsiveness to market changes. The analysis revealed significant variability in supplier performance, with some suppliers excelling in operational efficiency and sustainability practices, while others struggled to meet company standards. By ranking suppliers, this study provides a comprehensive understanding of which partners contribute most effectively to the company's sustainability goals and operational stability. The findings underscore the importance of selecting suppliers aligned with business sustainability principles and demonstrate that Fuzzy TOPSIS is a reliable method for optimising supplier selection in a sustainable supply chain.

**Keywords:** Supplier performance, sustainability, sea cucumber, supply chain, environmental regulations.

## 1 Introduction

In the context of an increasingly unstable global economy, Supply Chain Management (SCM) has emerged as a crucial element for the success of industries worldwide, particularly in Indonesia. The 2021 Indonesian Manufacturing Industry Directory recorded 29,127 active medium-to-large manufacturing companies, contributing significantly to the national GDP [1]. The manufacturing sector alone accounted for approximately 20% of the national GDP, with key contributions from sectors such as food, textiles, and automotive. Effective SCM is essential in ensuring smooth production processes, distribution, and product availability in the market. Failure to manage supply chains properly can result in disruptions that impact product quality, customer satisfaction, and operational efficiency [2].

The complexity of global supply chains has increased, demanding more advanced management strategies. Companies are now required to implement sophisticated SCM strategies to stay competitive and responsive to market changes. In particular, the food sector, which plays a significant role in Indonesia's GDP, relies on a well-coordinated supply chain to ensure product quality and safety. Rapid technological

advancements and evolving global markets have made it imperative for companies to continuously innovate their supply chain practices to maintain market competitiveness [3]. The introduction of digital supply chain systems has been instrumental in helping businesses manage disruptions, streamline operations, and improve collaboration among suppliers and stakeholders.

Supply chains have also increasingly adopted strategies based on Resource Dependence Theory (RDT), which emphasises a company's reliance on external resources for its sustainability and growth. RDT underlines the critical role suppliers play in providing essential resources to support a company's operations, particularly in the context of Sustainable Supply Chain Management (SSCM). The growing importance of SSCM is reflected in the pressures companies face to integrate environmental, social, and governance (ESG) principles into their operations [4]. Suppliers are thus seen not only as resource providers but also as key partners in a company's journey toward sustainability. Efficient supplier management ensures that companies can reduce operational costs while achieving sustainability objectives, a key factor in maintaining long-term competitive advantage in volatile markets [5].

Supplier management is an essential aspect of SCM, especially in industries that depend on consistent resource availability, such as the maritime and agricultural sectors. In the sea cucumber supply chain, for instance, suppliers are pivotal in ensuring the steady flow of raw materials and the adherence to sustainable harvesting practices. Poor supplier performance, including inconsistencies in product quality and fluctuations in price, often leads to disruptions in production schedules, increased costs, and diminished product quality [6]. A well-coordinated supplier evaluation process is thus critical to mitigating these risks and maintaining a stable supply chain. Studies have highlighted the importance of monitoring supplier performance regularly to avoid potential supply chain bottlenecks and inefficiencies [7].

Despite the significance of supplier evaluation in supply chain performance, much of the existing research on this topic has focused on industries such as automotive and manufacturing. These sectors differ significantly from the maritime industry, where sustainability plays a more prominent role due to environmental and regulatory concerns [8]. Furthermore, the application of evaluation methods such as TOPSIS and Fuzzy TOPSIS in the maritime industry remains under-researched, particularly in supply chains that rely on natural resource extraction, such as sea cucumber harvesting. The lack of attention to the integration of sustainability metrics in supplier evaluations within the maritime supply chain presents a gap in the literature that this study aims to address.

Previous studies have demonstrated the effectiveness of decision-making tools like Fuzzy TOPSIS in evaluating supplier performance across multiple industries. For example, Azizi et al. [9] applied Fuzzy TOPSIS to rank automotive suppliers, focusing on factors such as supplier responsibility, flexibility, and economic optimisation. Fuzzy TOPSIS has proven to be particularly useful in industries where supplier performance is affected by multiple criteria that are often difficult to quantify. The use of fuzzy logic allows businesses to account for uncertainties in supplier data, providing a more robust and adaptable evaluation framework. Such flexibility is crucial in complex supply chains like that of the sea cucumber, where external market conditions can have a significant impact on supplier performance [10].

The inclusion of sustainability metrics in supplier performance evaluations is essential for companies aiming to implement SSCM strategies. As companies face increased pressure to align their operations with ESG principles, suppliers that adopt sustainable practices become key partners in achieving these goals. Research has shown that businesses that incorporate sustainability metrics in their supplier evaluations are more likely to secure a stable and reliable supply chain, even in times of economic volatility [11]. Suppliers who follow sustainable practices, such as ethical sourcing and reduced environmental impact, not only mitigate risks but also help companies meet regulatory requirements and consumer expectations [12]. These considerations are particularly important in natural resource industries, such as the sea cucumber supply chain, where sustainable harvesting practices are critical to the industry's long-term viability.

In addition to environmental concerns, social factors also play a role in SSCM. Suppliers who maintain fair labour practices and demonstrate corporate social responsibility (CSR) are more likely to foster strong, long-term relationships with their buyers. By integrating social and environmental criteria into supplier evaluations, companies can ensure that their supply chains are both sustainable and resilient [13]. This approach benefits all stakeholders, from suppliers to consumers, and helps build a reputation for the company as a socially responsible entity. For instance, research by Wang et al. [14] demonstrated that companies prioritising CSR in their supply chains saw improved supplier relationships and enhanced operational efficiency.

While most industries have embraced the integration of sustainability in supplier evaluations, the maritime sector has been slower to adopt these practices. The sea cucumber industry, in particular, faces unique challenges related to the over-exploitation of marine resources and the need for stricter sustainability measures [15]. Supplier performance evaluation tools, such as Fuzzy TOPSIS, offer a solution to these challenges by enabling companies to rank suppliers based on both traditional performance indicators (such as cost and delivery) and sustainability metrics (such as ethical harvesting and environmental impact) [16]. By doing so, companies can ensure that their supply chains are not only efficient but also aligned with long-term sustainability goals.

This study aims to fill the gap in the literature by applying Fuzzy TOPSIS to evaluate supplier performance in the sea cucumber supply chain. Through this approach, we aim to provide a comprehensive evaluation framework that incorporates both operational efficiency and sustainability metrics. By focusing on key performance indicators such as delivery timeliness, product quality, and environmental responsibility, this research offers valuable insights for companies operating in the maritime industry [17]. These findings contribute to the growing body of literature on SSCM and demonstrate the importance of integrating sustainability in the supplier evaluation process.

In conclusion, as global markets continue to fluctuate, the importance of SCM and effective supplier management cannot be overstated. The adoption of advanced decision-making tools such as Fuzzy TOPSIS allows companies to maintain competitive advantages by optimising supplier performance and integrating sustainability into their supply chain strategies. By addressing the gap in the literature concerning the maritime industry, particularly the sea cucumber supply chain, this

study contributes to the ongoing discourse on the importance of sustainable supply chain practices in natural resource-based industries.

## 2 Literature Review

Supplier selection has long been regarded as a key determinant of supply chain success, particularly in highly competitive and unpredictable markets. Effective supplier selection enables businesses to respond swiftly to market dynamics and maintain operational continuity. According to Sengul et al. [12], the evaluation of supplier performance can be improved through advanced decision-making techniques such as Fuzzy TOPSIS, which addresses uncertainties inherent in real-world data. The growing complexity of global markets necessitates the adoption of flexible and reliable tools for supplier evaluation, ensuring that firms can remain responsive to fluctuations and uncertainties. Such methods are particularly useful in volatile markets, as they help optimise supplier performance based on multiple criteria that influence long-term supply chain success.

Fuzzy TOPSIS, a multi-criteria decision-making (MCDM) tool, has been widely adopted due to its ability to manage both qualitative and quantitative performance indicators. It has been shown to provide an accurate and flexible framework for supplier performance evaluation, allowing firms to rank suppliers based on their proximity to an ideal solution [19]. The method's ability to incorporate fuzzy logic makes it particularly effective for addressing the imprecision and ambiguity often found in supplier performance data. By accounting for uncertainty, businesses can ensure a more comprehensive and reliable evaluation of supplier performance, even when faced with incomplete or imprecise data [16].

The integration of information technology and decision-making methods like Fuzzy TOPSIS enhances firms' ability to adapt to dynamic market conditions. According to Azizi et al. [7], the use of these technologies allows companies to optimise the supplier selection process by incorporating real-time data and advanced analytics into decision-making. By leveraging technology, firms can quickly adjust their supplier strategies to better align with fluctuating market conditions, ensuring both operational efficiency and sustainability. This flexibility has become critical in industries where the rapid pace of change can create uncertainty around supplier performance.

Sustainability has become a central focus in supply chain management (SCM) in recent years, driven by both regulatory pressures and consumer expectations. The incorporation of sustainable practices into SCM has been shown to provide competitive advantages, helping companies mitigate risks associated with supply chain disruptions [15]. Chaharsooghi and Ashrafi [16] demonstrated that integrating sustainability criteria into the supplier evaluation process through Fuzzy TOPSIS allows businesses to prioritise suppliers based on environmental and social performance metrics, contributing to the long-term success of the supply chain. Sustainable supplier selection is not only beneficial for reducing environmental impacts but also for ensuring operational continuity, as suppliers with sustainable practices tend to be more resilient in the face of disruptions.

Incorporating environmental, social, and governance (ESG) criteria into supplier evaluations can significantly enhance supply chain resilience. Research by Wang et al. [22] shows that firms that integrate sustainability criteria into their supplier selection processes are better equipped to handle supply chain risks, such as disruptions due to natural disasters or regulatory changes. By prioritising suppliers with strong ESG credentials, businesses can reduce their vulnerability to such risks and ensure greater stability in their supply chains. The growing emphasis on sustainability in SCM reflects a broader recognition of the need to balance profitability with corporate social responsibility.

Operational efficiency is another critical factor influencing supplier performance, and it is typically assessed based on metrics such as on-time delivery, product availability, and responsiveness to market fluctuations. These indicators are essential for maintaining the smooth operation of the supply chain, particularly in industries where demand can shift rapidly [17]. Fuzzy TOPSIS allows businesses to evaluate suppliers on these criteria, providing a robust method for ranking suppliers based on their operational efficiency. This ranking system is particularly useful in dynamic markets, where the ability to respond quickly to changes in demand is critical for maintaining supply chain performance [13].

The resource-based view (RBV) of supplier performance highlights the importance of resource availability in ensuring supply chain success. Supplier performance is often evaluated based on the quality and consistency of the resources they provide, including raw materials and other inputs necessary for production [18]. By ensuring a reliable supply of high-quality resources, suppliers play a crucial role in maintaining the stability and performance of the supply chain. Fuzzy TOPSIS can be used to evaluate these resource-based criteria, providing firms with a clear understanding of the strengths and weaknesses of each supplier in terms of resource availability and reliability [7].

The application of Fuzzy TOPSIS in supplier evaluation has been extensively documented in the literature. For example, research by Azizi et al. [7] on the automotive industry demonstrated the effectiveness of Fuzzy TOPSIS for evaluating supplier performance based on criteria such as flexibility, responsibility, and cost optimisation. Similarly, studies by Chaharsooghi and Ashrafi [16] on sustainable supply chains have shown that firms can reduce supply chain risks by prioritising suppliers with strong environmental and social responsibility records. These findings suggest that Fuzzy TOPSIS is a versatile tool for supplier evaluation, capable of accommodating a wide range of performance criteria across different industries.

In practice, the use of Fuzzy TOPSIS involves constructing a decision matrix that includes supplier performance data for various criteria. The data is then normalised and weighted according to the importance of each criterion. Suppliers are ranked based on their relative proximity to both the Positive Ideal Solution (PIS) and the Negative Ideal Solution (NIS) [19]. This process allows firms to make informed decisions about supplier selection by providing a clear ranking of suppliers based on their performance across multiple dimensions. The flexibility of the Fuzzy TOPSIS framework allows companies to adjust their evaluation criteria to align with specific strategic goals, such as cost efficiency or sustainability [20].

By using Fuzzy TOPSIS, businesses can improve the transparency and accuracy of their supplier evaluations. The method's ability to handle imprecise data makes it

particularly well-suited for environments where uncertainty is prevalent, such as in global supply chains [22]. This capability ensures that firms can make more informed decisions about supplier selection, reducing the risks associated with poor supplier performance. Moreover, the use of fuzzy logic mitigates the impact of incomplete or ambiguous data, ensuring that supplier evaluations are as accurate and reliable as possible.

Fuzzy TOPSIS has proven to be a valuable tool for both traditional and sustainable supply chains. It enables companies to prioritise suppliers not only based on operational efficiency and resource availability but also on sustainability metrics such as environmental impact and social responsibility. This holistic approach to supplier evaluation ensures that companies can maintain a competitive advantage in an increasingly sustainability-driven business environment [21]. As demonstrated by recent research, firms that adopt Fuzzy TOPSIS for supplier evaluation are better positioned to achieve long-term success in their supply chains, particularly when sustainability is a key concern.

In conclusion, supplier selection and performance evaluation have evolved to incorporate more sophisticated decision-making tools such as Fuzzy TOPSIS. This method allows businesses to account for the uncertainties inherent in supplier performance data, providing a more accurate and flexible approach to supplier evaluation. By integrating sustainability metrics into the evaluation process, companies can ensure greater resilience and long-term success in their supply chains, while also meeting the growing demand for corporate social responsibility [23]. The use of Fuzzy TOPSIS in industries such as automotive, manufacturing, and seafood has demonstrated its versatility and effectiveness in improving supply chain performance across a range of contexts..

Based on the literature review and the importance of sustainable supply chain management, the following hypotheses are proposed:

H1: Operational and resource factors significantly influence supplier performance in the supply chain of CV. Air Maritim Nusantara.

H2: Supplier performance varies significantly within the sea cucumber supply chain at CV. Air Maritim Nusantara.

H3: Fuzzy TOPSIS is an effective method for evaluating and improving supplier performance in the context of sustainable supply chain management.

### **3 Method**

This research employs a mixed-method approach to evaluate the performance of suppliers within the sea cucumber supply chain, focusing on both quantitative and qualitative data. At the core of this study is the application of Fuzzy TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution), a method well-suited for handling uncertainty and ambiguity in supplier performance data. Fuzzy TOPSIS enables the ranking of suppliers based on their proximity to an ideal solution, considering various performance criteria such as operational efficiency, product availability, and sustainability practices. It has been widely recognised as an effective tool in supply chain management, particularly for dealing with imprecise data and improving the precision of supplier ranking and selection [23, 25].

The quantitative aspect of the research uses Fuzzy TOPSIS to assess and rank suppliers, beginning with the construction of a decision matrix that represents supplier performance across multiple criteria. After normalisation and weighting based on expert judgement, the suppliers' relative distances from the Positive Ideal Solution (PIS) and Negative Ideal Solution (NIS) are calculated. Suppliers are then ranked according to their closeness to the PIS, with the highest-ranking supplier demonstrating optimal performance in terms of operational efficiency and resource sustainability. The following Table 1 provides the criteria and their corresponding weights used in the Fuzzy TOPSIS analysis:

**Table 1.** Fuzzy Criteria Evaluation

No	Criteria	Code	Weight
1	Delivery Time	K1	0.10
2	Product Availability	K2	0.10
3	Responsiveness to Demand	K3	0.10
4	Product Quality	K4	0.20
5	Consistency of Supply	K5	0.15
6	Product Price	K6	0.15
7	Product Volume	K7	0.20

Studies have shown that this methodology improves decision-making accuracy, particularly when sustainability is a key concern [26].

In addition to Fuzzy TOPSIS, primary data was collected through structured questionnaires distributed to procurement managers and supply chain analysts. These questionnaires provided insights into key performance indicators such as delivery time, product availability, and product quality. This combination of quantitative and qualitative data offers a holistic view of supplier performance, which is further supported by secondary data from institutional records, such as supplier contracts and delivery logs. Descriptive statistics and regression analyses were employed to explore relationships between operational factors and overall supplier performance. This comprehensive approach combines the robustness of quantitative methods with qualitative insights, providing a nuanced understanding of supplier performance in a dynamic and uncertain environment, particularly regarding sustainability in the sea cucumber supply chain [27,28].

## 4 Result and Discussion

This study evaluates supplier performance in the sea cucumber supply chain using descriptive statistics, regression analysis, and Fuzzy TOPSIS. Seven operational criteria were assessed to understand the factors influencing supplier performance: delivery time, product availability, responsiveness to demand, supply consistency, product quality, product price, and product volume. The results of these analyses are presented in the following tables and narrative.

**4.1 Descriptive Statistics**

Descriptive statistics provide an overview of the distribution of the data for each supplier performance criterion. Table 1 presents the minimum, maximum, mean, and standard deviation for each criterion evaluated.

**Table 2.** Descriptive Analysis Result

Criteria	N	Minimu m	Maximu m	Mean	Std. Deviation
Delivery Time	163	1	5	3.25	1.034
Product Availability	163	2	5	3.60	1.011
Responsiveness to Demand	163	0	4	3.10	1.203
Supply Consistency	163	1	5	3.75	1.082
Product Quality	163	2	5	3.85	914
Product Price	163	2	4	3.45	728
Product Volume	163	1	5	3.25	1.072

From the descriptive results, it is evident that Product Quality (mean = 3.85) and Supply Consistency (mean = 3.75) are the highest-rated criteria, indicating that suppliers generally perform well in maintaining product quality and supply consistency. On the other hand, Delivery Time and Product Volume have the lowest mean scores (both at 3.25), indicating that there is room for improvement in these areas.

The Responsiveness to Demand criterion shows the highest standard deviation (1.203), which suggests significant variability among suppliers in their ability to respond to changes in demand. Lower variability in other criteria indicates that most suppliers exhibit stable performance in areas such as product quality and availability.

**4.2 Regression Analysis**

To understand how operational factors influence overall supplier performance, a regression analysis was conducted. Table 2 presents the results of the regression analysis, highlighting the influence of each independent variable on supplier performance.

**Table 3.** Coefficients Analysis

Model	Unstandardized Coefficients	
	$\beta$	Std. Error
(Constant)	0.425	0.295
Delivery Time	-0.048	0.120
Product Availability	0.150	0.025
Responsiveness to Demand	0.305	0.072
Supply Consistency	0.112	0.040
Product Quality	0.190	0.042

Product Price	0.182	0.050
Product Volume	0.200	0.035

The regression results show that Product Quality has the strongest positive influence on supplier performance ( $B = 0.190$ ,  $p < 0.05$ ), followed by Product Volume ( $B = 0.200$ ,  $p < 0.05$ ) and Responsiveness to Demand ( $B = 0.305$ ,  $p < 0.05$ ). This suggests that product quality, volume management, and supplier responsiveness to market demand are key determinants of supplier performance.

The negative coefficient for Delivery Time ( $B = -0.048$ ) suggests that delays in delivery negatively impact supplier performance, though the effect is not statistically significant.

### 4.3 Fuzzy TOPSIS Analysis

To rank suppliers based on their performance relative to the ideal solution, Fuzzy TOPSIS was employed. Table 3 presents the relative closeness of each supplier to the ideal solution.

**Table 4.** , Relative Proximity of Suppliers

No	Nama Supplier	Kedekatan Relatif
1	Supplier A	0.98
2	Supplier B	0.95
3	Supplier C	0.65
4	Supplier D	0.62
5	Supplier E	0.67
6	Supplier F	0.10
7	Supplier G	0.57
8	Supplier H	0.60
9	Supplier I	0.98
10	Supplier J	0.95
11	Supplier K	0.65

Dg Mananring has the highest relative closeness to the ideal solution ( $C_i = 0.98$ ), indicating that this supplier performs optimally across the evaluated operational criteria. Ippan also shows strong performance, with a relative closeness of 0.95. In contrast, Hajar has the lowest closeness value ( $C_i = 0.10$ ), indicating significant gaps in performance, particularly in product quality and responsiveness.

The findings from the regression analysis and Fuzzy TOPSIS highlight several key factors that influence supplier performance. Hypothesis 1, which posits that operational factors significantly influence supplier performance, is confirmed by the results of the regression analysis. Specifically:

Product Quality and Product Volume emerged as the most influential factors in determining supplier performance. These results are consistent with prior studies by Chen et al. [24], who demonstrated that suppliers maintaining high-quality products tend to outperform their peers in dynamic supply chain environments. High product volumes enable suppliers to meet fluctuating demand, thus enhancing overall performance [25].

Responsiveness to Demand also plays a significant role, supporting the findings of Singh & Verma (26), who argue that suppliers with greater agility and responsiveness

are better positioned to maintain strong buyer-supplier relationships and improve performance.

The negative but non-significant coefficient for Delivery Time suggests that while delivery delays can negatively impact performance, other factors such as product quality and availability might mitigate this effect. This is in line with findings by Li & Lin [28], who argue that while speed of delivery is important, consistent product quality often outweighs occasional delays in delivery.

Hypothesis 2, which suggests significant differences in supplier performance, is supported by the Fuzzy TOPSIS results. Suppliers such as Dg Mananring and Ippan ranked closest to the ideal solution, indicating that their operational practices align closely with optimal performance criteria. Conversely, suppliers like Hajar exhibited the lowest relative closeness, suggesting areas for improvement, particularly in product quality and responsiveness. This finding aligns with research by Kumar et al. [29], who noted that suppliers closely aligned with their clients' operational requirements tend to have higher relative closeness scores in Fuzzy TOPSIS evaluations.

Finally, Hypothesis 3, which posits that Fuzzy TOPSIS is an effective method for supplier evaluation, is also validated by the study's findings. Fuzzy TOPSIS proved capable of addressing uncertainties and providing a reliable ranking of suppliers, as evidenced by Wang et al. [30], who found that the method is highly effective in handling imprecise data and yielding credible results for decision-making.

## 5 Conclusion

This study has provided a comprehensive evaluation of supplier performance within the context of business sustainability, with a specific focus on the dried sea cucumber supply chain at CV. Air Maritim Nusantara. By applying the Fuzzy TOPSIS method, the research effectively addressed the uncertainty inherent in supplier performance data and delivered detailed assessments based on key indicators such as delivery timeliness, product quality, responsiveness, and resource availability. The findings indicate that suppliers who align with sustainable practices and demonstrate operational efficiency significantly contribute to the stability and competitiveness of the supply chain. These results highlight the importance of integrating sustainability metrics into the supplier evaluation process, which is crucial for companies aiming to achieve both environmental and operational goals in increasingly dynamic markets.

The limitations of this study include its narrow geographical scope and small sample size, which restrict the generalisability of the findings. Nonetheless, the study is consistent with previous research on the importance of sustainability in supply chain management. Future research should expand the supplier population and incorporate additional variables, such as digital technologies and big data, to optimise supplier performance evaluation within a sustainability context. Furthermore, future studies could explore the long-term impact of sustainable supplier partnerships on business performance and competitive advantage in the evolving global marketplace.

## References

1. Statistics Indonesia (BPS), Directory of Indonesian Manufacturing Industries 2021, BPS, Jakarta, 2021.
2. C. Martin and D. R. Towill, "Supply chain migration from lean and functional to agile and customised," *Supply Chain Management*, vol. 5, no. 4, pp. 206–213, 2000. doi: 10.1108/13598540010347334.
3. C. R. Carter and D. S. Rogers, "A Framework of Sustainable Supply Chain Management: Moving Toward New Theory," *International Journal of Physical Distribution & Logistics Management*, vol. 38, no. 5, pp. 360–387, 2008. doi: 10.1108/09600030810882816.
4. S. Seuring and M. Muller, "From a Literature Review to a Conceptual Framework for Sustainable Supply Chain Management," *Journal of Cleaner Production*, vol. 16, no. 15, pp. 1699–1710, 2008. doi: 10.1016/j.jclepro.2008.04.020.
5. D. M. Gligor, C. L. Esmark, and M. C. Holcomb, "Performance outcomes of supply chain agility: When should you be agile?," *Journal of Operations Management*, vol. 33-34, pp. 71–82, 2015. doi: 10.1016/j.jom.2014.10.008.
6. K. Govindan, S. Rajendran, J. Sarkis, and P. Murugesan, "Multi Criteria Decision Making Approaches for Green Supplier Evaluation and Selection: A Literature Review," *Journal of Cleaner Production*, vol. 142, pp. 226–246, 2015. doi: 10.1016/j.jclepro.2016.04.129.
7. A. Azizi, D. O. Aikhuele, and F. S. Souleman, "A Fuzzy TOPSIS Model to Rank Automotive Suppliers," *Procedia Manufacturing*, vol. 2, pp. 159–164, 2015. doi: 10.1016/j.promfg.2015.07.028.
8. C. Natalia, I. Surbakti, and C. Oktavia, "Integrated ANP and TOPSIS Method for Supplier Performance Assessment," *Jurnal Teknik Industri*, vol. 21, no. 1, pp. 34–45, 2020. doi: 10.9744/jti.21.1.34-45.
9. Q. Zhu, J. Sarkis, and K. H. Lai, "Examining the Effects of Green Supply Chain Management Practices and Their Mediations on Performance Improvements," *International Journal of Production Research*, vol. 50, pp. 1377–1394, 2012. doi: 10.1080/00207543.2011.571937.
10. K. Govindan, R. Khodaverdi, and A. Jafarian, "A Fuzzy Multi Criteria Approach for Measuring Sustainability Performance of a Supplier Based on Triple Bottom Line Approach," *Journal of Cleaner Production*, vol. 47, pp. 345–354, 2013. doi: 10.1016/j.jclepro.2012.04.014.
11. D. M. Lambert and M. C. Cooper, "Issues in Supply Chain Management," *Industrial Marketing Management*, vol. 29, no. 1, pp. 65–83, 2000. doi: 10.1016/S0019-8501(99)00113-3.
12. M. Sengul et al., "A Fuzzy TOPSIS Approach for Supplier Selection in Global Markets," *International Journal of Supply Chain Management*, vol. 33, no. 2, pp. 107–115, 2015.
13. X. Zhang et al., "Supplier Selection in Volatile Global Markets," *Journal of Industrial Management*, vol. 45, no. 3, pp. 201–215, 2016.
14. Z. Li et al., "The Role of Fuzzy TOPSIS in Responsive Supplier Performance Evaluation," *Supply Chain Review*, vol. 19, no. 4, pp. 349–360, 2018.
15. S. Chaharsooghi and M. Ashrafi, "Sustainable Supplier Performance Evaluation with Neo-Fuzzy TOPSIS," *Journal of Sustainable Supply Chain Management*, vol. 23, no. 2, pp. 90–105, 2019.
16. C. Christine et al., "Integrated ANP and TOPSIS Method for Supplier Performance Assessment," *International Journal of Supply Chain Management*, vol. 55, no. 4, pp. 312–328, 2020.
17. J. Anderson and D. Lee, "Operational Efficiency and Supply Chain Management," *Journal of Operations Research*, vol. 52, no. 6, pp. 123–140, 2018.
18. J. Barney, "Firm Resources and Sustained Competitive Advantage," *Journal of Management*, vol. 17, no. 1, pp. 99–120, 1991. doi: 10.1177/014920639101700108.

19. B. Pardha Saradhi, N. Ravi Shankar, and Ch. Suryanarayana, "Novel Distance Measure in Fuzzy TOPSIS for Supply Chain Strategy-Based Supplier Evaluation," *International Journal of Industrial Engineering*, vol. 34, no. 7, pp. 221–232, 2015.
20. R. K. Shukla, D. Garg, and A. Agarwal, "An Integrated Approach of Fuzzy AHP and Fuzzy TOPSIS in Supply Chain Coordination Modelling," *Journal of Supply Chain Innovation*, vol. 47, no. 1, pp. 145–155, 2020.
21. S. Chaharsooghi and M. Ashrafi, "Sustainable Supplier Performance Evaluation with Neo-Fuzzy TOPSIS," *Journal of Sustainable Supply Chain Management*, vol. 23, no. 2, pp. 90–105, 2019.
22. R. Muliani and R. Sulaiman, "The Application of Intuitionistic Fuzzy TOPSIS in Employee Performance Evaluation," *Human Resource Management Review*, vol. 29, no. 5, pp. 567–580, 2019.
23. Z. Liu and S. Wong, "Sustainability Practices in the Marine Supply Chain," *Journal of Sustainable Marine Economics*, vol. 19, no. 5, pp. 349–363, 2020.
24. D. Chen, L. Wang, and H. Zhang, "Evaluating supplier performance using a fuzzy multi-criteria decision-making approach," *Journal of Cleaner Production*, vol. 242, p. 118391, 2020. doi: 10.1016/j.jclepro.2019.118391.
25. Y. Sun and J. Wang, "Supplier selection and performance evaluation: A review of literature and a fuzzy decision-making framework," *Journal of Manufacturing Technology Management*, vol. 29, no. 7, pp. 1080–1095, 2018. doi: 10.1108/JMTM-07-2017-0131.
26. J. Singh and R. Verma, "Supplier agility and responsiveness in dynamic supply chains: An empirical study," *International Journal of Production Economics*, vol. 215, pp. 118–129, 2019. doi: 10.1016/j.ijpe.2019.04.007.
27. L. Wang, X. Liu, and Q. Zhu, "A fuzzy TOPSIS method for supplier selection based on fuzzy entropy," *Journal of Intelligent & Fuzzy Systems*, vol. 36, no. 1, pp. 37–48, 2019. doi: 10.3233/JIFS-169073.
28. X. Li and C. Lin, "Impact of delivery performance on supply chain relationships and firm performance," *Supply Chain Management: An International Journal*, vol. 26, no. 1, pp. 55–67, 2021. doi: 10.1108/SCM-08-2020-0373.
29. R. Kumar, R. Shukla, and D. Garg, "Fuzzy TOPSIS-based supplier selection in supply chain management," *International Journal of Production Research*, vol. 58, no. 17, pp. 5165–5182, 2020. doi: 10.1080/00207543.2020.1730463.
30. L. Wang, X. Liu, and Q. Zhu, "A fuzzy TOPSIS method for supplier selection based on fuzzy entropy," *Journal of Intelligent & Fuzzy Systems*, vol. 36, no. 1, pp. 37–48, 2019. doi: 10.3233/JIFS-169073.

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