



Ranking the Financial Performance of Rubber and Plastic Companies Listed on the Tehran Stock Exchange: An Integrated Fuzzy AHP–TOPSIS Approach

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ARTICLE INFO	ABSTRACT
Article History: Received 3 January 2025 Received in revised form 14 March 2025 Accepted 3 April 2025 Available online 4 June 2025	Evaluating the financial performance of listed companies is essential for informed investment decisions, yet a single financial indicator rarely provides a complete picture. This study develops an integrated fuzzy multi-criteria decision-making (MCDM) framework to evaluate and rank the financial performance of ten rubber and plastic companies listed on the Tehran Stock Exchange (TSE). Four groups of financial criteria identified from the literature (liquidity, leverage, activity and profitability ratios) were weighted using Chang's extent analysis method of the fuzzy analytic hierarchy process (FAHP), based on pairwise comparisons by a panel of experts in finance and the capital market. Financial data for 2023 and 2024 were then used to construct the decision matrix, and the companies were ranked with the TOPSIS method. Liquidity ratios received the highest weight (0.389), followed by profitability (0.249), leverage (0.219) and activity ratios (0.143). Company A10 obtained the highest closeness coefficient ($CC = 0.88$), followed by A4 (0.80) and A7 (0.76). The proposed framework offers investors and portfolio managers a systematic and replicable tool for comparing the financial performance of companies and supporting stock selection within an industry. Because the results depend on expert judgments and a two-year period, future studies should examine the robustness of the rankings through sensitivity analysis and longer time horizons.
Keywords: Financial Performance Evaluation; Fuzzy AHP; TOPSIS; Multi-Criteria Decision Making; Financial Ratios; Tehran Stock Exchange	

1. INTRODUCTION

Every organization has an urgent need for an evaluation system in order to know the level of desirability and quality of its activities, especially in complex and dynamic environments. On the other hand, the absence of an evaluation and control system in a system is considered to mean the lack of communication with the internal and external environment of the organization, the consequences of which are old age and ultimately the death of the organization. The phenomenon of organizational death may not be felt by top managers of organizations due to the fact that it does not happen all at once. However, studies show that the lack of a feedback system makes it impossible to carry out necessary reforms for the growth, development and improvement of the organization's activities. Finally,

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this phenomenon is organizational death. The issue of performance evaluation has challenged researchers and users for many years. In the past, business organizations only used financial indicators as a performance evaluation tool; Until "Kaplan and Norton" in the early 1980s, after reviewing and evaluating management accounting systems, they revealed many of the inefficiencies of this information for evaluating the performance of organizations, which is caused by the increase in complexity, the organization of the environment, and market competition. Financial indicators do not report accurately on the cost of processes, products, and customers, and they only emphasize the control process of a part instead of the whole system.

2. RESEARCH METHODOLOGY

In this paper, the weights of each criterion are calculated using FAHP Method. After that, TOPSIS is utilized to rank the alternatives. Finally, we rank the Companies based on these results. Before explaining about FAHP method, it has been described fuzzy sets and fuzzy numbers as follow:

2.1. Fuzzy Sets and Fuzzy Numbers

Fuzzy set theory, which was introduced by Zadeh (1965) to deal with problems in which a source of vagueness is involved, has been utilized for incorporating imprecise data into the decision framework. A fuzzy set $\tilde{A}$ can be defined mathematically by a membership function $\mu_{\tilde{A}}(X)$, which assigns each element x in the universe of discourse X a real number in the interval $[0,1]$. A triangular fuzzy number $\tilde{A}$ can be defined by a triplet (a, b, c) as illustrated in Fig 1.

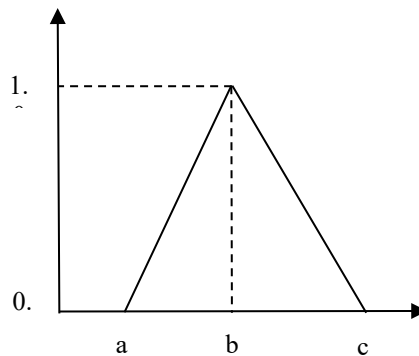


Fig. 1. A triangular fuzzy number A.

The membership function $\mu_{\tilde{A}}(X)$ is defined as

$$\mu_{\tilde{A}}(x) = \begin{cases} \frac{x-l}{m-l} & l \leq x \leq m \\ \frac{x-u}{m-u} & m \leq x \leq u \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

Where l , m , and u are also considered as the lower bound, the mean bound, and the upper bound, respectively. The triangular fuzzy number $\tilde{N}$ is often represented as (l,m,u) . According to Table 1, criteria compare with each other. After pairwise comparisons, are finished at a level, a fuzzy reciprocal judgment matrix $\tilde{A}$ can be established as:

$$\tilde{A} = \{\tilde{a}_{ij}\} = \begin{bmatrix} \tilde{a}_{11} & \tilde{a}_{12} & \dots & \tilde{a}_{1n} \\ \tilde{a}_{21} & \tilde{a}_{22} & \dots & \tilde{a}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{a}_{n1} & \tilde{a}_{n2} & \dots & \tilde{a}_{nn} \end{bmatrix} \quad (2)$$

Table 1. Linguistic variables for important of each criteria

linguistic variables	triangular fuzzy numbers
very low	(0.00,0.00,0.00)
low	(0.10,0.20,0.30)
medium low	(0.20,0.35,0.50)
medium	(0.40,0.50,0.60)
medium high	(0.50,0.65,0.80)
high	(0.70,0.80,0.90)
very high	(0.80,1.00,1.00)

Where n is the number of the related elements at this level, and $a_{ij} = 1/a_{ji}$. Basic arithmetic operations on triangular fuzzy numbers $A_1 = (l_1, m_1, u_1)$, where $l_1 \leq m_1 \leq u_1$, and $A_2 = (l_2, m_2, u_2)$, where $l_2 \leq m_2 \leq u_2$, can be shown as follows:

Addition:

$$A_1 \oplus A_2 = (l_1 + l_2, m_1 + m_2, u_1 + u_2) \quad (3)$$

Subtraction:

$$A_1 \ominus A_2 = (l_1 - u_2, m_1 - m_2, u_1 - l_2) \quad (4)$$

Multiplication: if K is a scalar

$$K \otimes A_1 = \begin{cases} (kl_1, km_1, ku_1), & k > 0 \\ (ku_1, km_1, kl_1), & k < 0 \end{cases}$$

$$A_1 \otimes A_2 \approx (l_1 l_2, m_1 m_2, u_1 u_2), \text{ if } l_1 \geq 0, l_2 \geq 0 \quad (5)$$

$$\text{Division: } A_1 \oslash A_2 \approx \left(\frac{l_1}{u_2}, \frac{m_1}{m_2}, \frac{u_1}{l_2} \right),$$

$$\text{if } l_1 \geq 0, l_2 \geq 0 \quad (6)$$

Although multiplication and division operations on triangular fuzzy numbers do not necessarily yield a triangular fuzzy number, triangular fuzzy number approximations can be used for many practical applications (Kaufmann and Gupta, 1988). Triangular fuzzy numbers are appropriate for quantifying the vague information about most decision problems including Facility location selection. The primary reason for using triangular fuzzy numbers can be stated as their intuitive and computational-efficient representation [27]. A linguistic variable is defined as a variable whose values are not numbers, but words or sentences in natural or artificial language. The concept of a linguistic variable appears as a useful means for providing approximate characterization of phenomena that are too complex or ill-defined to be described in conventional quantitative terms [28].

2.2. Fuzzy AHP

The fuzzy hierarchical analysis process is one of the most famous multi-criteria decision-making techniques introduced by Saaty. When we are faced with several options and indicators in decision-making, this method can be useful. Although experts use their mental skills and abilities to make comparisons, it should be noted that the traditional hierarchical analysis process cannot fully reflect the human thinking style. In other words, the use of fuzzy sets is more compatible with linguistic and sometimes vague human explanations, and therefore it is better to use fuzzy sets (using fuzzy numbers) to make long-term predictions and make decisions in the real world. In 1983, two Dutch researchers named Lahrhorn and Pedrik proposed a method for the fuzzy hierarchical analysis process, which was based on the method of logarithmic least squares. The complexity of the steps of this method made this

method not used much. In 1996, another method called "developmental analysis method" was presented by Chang. The numbers used in this method are fuzzy triangular numbers.

2.3. TOPSIS Method

This study uses this method to obtain the value of priority and to rank alternatives. TOPSIS views a MADM problem with m alternatives as a geometric system with m points in the n -dimensional space. The method is based on the concept that the chosen alternative should have the shortest distance from the positive-ideal solution and the longest distance from the negative-ideal solution. TOPSIS defines an index called similarity to the positive-ideal solution and the remoteness from the negative-ideal solution. Then the method chooses an alternative with the maximum similarity to the positive-ideal solution [29]. It is often difficult for a decision-maker to assign a precise performance rating to an alternative for the attributes under consideration. The merit of using a fuzzy approach is to assign the relative importance of attributes using fuzzy numbers instead of precise numbers. This section extends the TOPSIS to the fuzzy environment. This method is particularly suitable for solving the group decision-making problem under fuzzy environment. We briefly review the rationale of fuzzy theory before the development of fuzzy TOPSIS. The mathematics concept borrowed from [30-31].

Step 1: Determine the weighting of evaluation criteria

A systematic approach to extend the TOPSIS is proposed to ranking strategies under a fuzzy environment in this section. In this paper the importance weights of various criteria and the ratings of qualitative criteria are considered as linguistic variables (as Table 2) [32].

Table 2. Linguistic scales for the importance of each criterion

Linguistic variable	Corresponding triangular fuzzy number
Very low (VL)	(0.0, 0.1, 0.3)
Low (L)	(0.1, 0.3, 0.5)
Medium (M)	(0.3, 0.5, 0.7)
High (H)	(0.5, 0.7, 0.9)
Very high (VH)	(0.7, 0.9, 1.0)

Step 2: Construct the fuzzy decision matrix and choose the appropriate linguistic variables for the alternatives with respect to criteria

$$\tilde{D} = \begin{matrix} & C_1 & C_2 & \dots & C_N \\ \begin{matrix} A_1 \\ A_2 \\ \vdots \\ A_M \end{matrix} & \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \dots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \dots & \tilde{x}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{x}_{m1} & \tilde{x}_{m2} & \dots & \tilde{x}_{mn} \end{bmatrix} \end{matrix}$$

$$i=1,2,\dots,m; j=1,2,\dots,n$$

$$\tilde{x}_{ij} = \frac{1}{k} (\tilde{x}_{ij}^1 + \tilde{x}_{ij}^2 + \dots + \tilde{x}_{ij}^k) \quad (7)$$

where $\tilde{x}_{ij}^k$ is the rating of alternative A_i with respect to criterion C_j evaluated by K expert and

$$\tilde{x}_{ij}^k = (a_{ij}^k, b_{ij}^k, c_{ij}^k)$$

Step 3: Normalize the fuzzy decision matrix

The normalized fuzzy decision matrix denoted by $\tilde{R}$ is shown as following formula:

$$\tilde{R} = [\tilde{r}_{ij}]_{m \times n}, i=1,2,\dots,m; j=1,2,\dots,n \quad (8)$$

Then the normalization process can be performed by following formula:

$$\text{Where } \tilde{r}_{ij} = \left(\frac{a_{ij}}{c_j^+}, \frac{b_{ij}}{c_j^+}, \frac{c_{ij}}{c_j^+} \right) c_j^+ = \max_i c_{ij}$$

The normalized $\tilde{r}_{ij}$ are still triangular fuzzy numbers. For trapezoidal fuzzy numbers, the normalization process can be conducted in the same way. The weighted fuzzy normalized decision matrix is shown as following matrix $\tilde{V}$:

$$\tilde{V} = [\tilde{v}_{ij}]_{m \times n}, i = 1, 2, \dots, m; j = 1, 2, \dots, n \quad (9)$$

$$\tilde{v}_{ij} = \tilde{r}_{ij} \otimes \tilde{w}_j \quad (10)$$

Step 4: Determine the fuzzy positive-ideal solution (FPIS) and fuzzy negative-ideal solution (FNIS)

According to the weighted normalized fuzzy decision matrix, we know that the elements $\tilde{V}_{ij}$ are normalized positive TFNs and their ranges belong to the closed interval $[0, 1]$. Then, we can define the FPIS A^+ and FNIS A^- as following formula:

$$A^+ = (\tilde{V}_1^+, \tilde{V}_2^+, \dots, \tilde{V}_n^+) \quad (11)$$

$$A^- = (\tilde{V}_1^-, \tilde{V}_2^-, \dots, \tilde{V}_n^-) \quad (12)$$

where $\tilde{V}_j^+ = (1, 1, 1)$ and $\tilde{V}_j^- = (0, 0, 0)$ $j = 1, 2, \dots, n$

Step 5: Calculate the distance of each alternative from FPIS and FNIS

The distances (d_i^+ and d_i^-) of each alternative A^+ from and A^- can be currently calculated.

$$d_i^+ = \sum_{j=1}^n d(\tilde{v}_{ij}, \tilde{V}_j^+), i = 1, 2, \dots, m \quad j = 1, 2, \dots, n \quad (13)$$

$$d_i^- = \sum_{j=1}^n d(\tilde{v}_{ij}, \tilde{V}_j^-), i = 1, 2, \dots, m \quad j = 1, 2, \dots, n \quad (14)$$

Step 6: Obtain the closeness coefficient (CC_i) and rank the order of alternatives

The CC_i is defined to determine the ranking order of all alternatives once the d_i^+ and d_i^- of each alternative have been calculated. Calculate similarities to ideal solution. This step solves the similarities to an ideal solution by formula:

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-} \quad i = 1, 2, \dots, m \quad (15)$$

According to the CC_i , we can determine the ranking order of all alternatives and select the best one from among a set of feasible alternatives.

3. CASE STUDY

After forming the decision hierarchy for Ranking the Financial Performance, the criteria to be used in evaluation process are assigned weights by using FAHP method. Geometric means of these values are found to obtain the pairwise comparison matrix on which there is a consensus (Table 3).

Table 3. Fuzzy comparison matrix

P	Liquidity ratios			Leverage ratios			Activity ratios			Profitability ratios		
	L	m	u	L	m	u	L	m	u	L	m	u
Liquidity ratios	1.00	1.00	1.00	3.43	4.57	6.17	1.67	2.70	3.73	0.25	1.89	3.26
Leverage ratios	0.16	0.22	0.30	1.00	1.00	1.00	1.87	3.28	4.30	0.62	0.90	1.40
Activity ratios	0.28	0.39	0.78	0.23	0.31	0.54	1.00	1.00	1.00	0.84	2.07	2.96
Profitability ratios	0.34	0.53	4.59	0.75	1.14	2.18	0.46	0.71	3.38	1.00	1.00	1.00

Then we calculate the magnitude matrix for each of the indicators, which is shown in Table 4.

Table 4. Matrix of the magnitude results

(V)	S1	S2	S3	S4
S1		1	1	1
S2	0.563743		1	1
S3	0.366968	0.763757668		1
S4	0.639884	0.87115552	0.974775709	

In the following, based on the results of Table 4, the weight vector of the indicators is obtained. Since these weights are not normalized, we must normalize these weights, the results of which are shown in Table 5.

Table 5. The weight of criteria

W_1	W_2	W_3	W_4
0.389015	0.219304351	0.142756047	0.24892

According to Table 5, the A_{10} is the best Company among other Companies.

Table 6. The result of TOPSIS method

	CC_i	Rank
A_1	0.47	9
A_2	0.65	5
A_3	0.53	8
A_4	0.80	2
A_5	0.63	6
A_6	0.42	10
A_7	0.76	3
A_8	0.56	7
A_9	0.67	4
A_{10}	0.88	1

According to Table 6, A_{10} is the best alternative among other.

4. CONCLUSION

This study proposed an integrated FAHP–TOPSIS framework to evaluate and rank the financial performance of ten rubber and plastic companies listed on the Tehran Stock Exchange. Four groups of financial criteria were identified: liquidity, leverage, activity, and profitability ratios. Their weights were determined using Chang’s extent analysis method based on expert judgments, and the companies were then ranked using TOPSIS based on their financial data for 2023 and 2024.

The results show that liquidity ratios carry the highest weight (0.389), followed by profitability (0.249), leverage (0.219), and activity ratios (0.143). The prominence of liquidity suggests that experts regard a company’s ability to

meet its short-term obligations as the most critical aspect of financial health in this industry. This is plausible given the sector's dependence on raw materials with volatile prices and its significant working capital requirements. In the ranking stage, company A10 achieved the highest closeness coefficient ($CC = 0.88$), followed by A4 (0.80) and A7 (0.76), while A6 (0.42) and A1 (0.47) ranked lowest.

These findings have several practical implications. First, individual and institutional investors and portfolio managers can use the proposed framework to compare companies systematically and support their stock selection decisions, rather than relying on a single financial indicator. Second, the managers of lower-ranked companies can use the results to identify the dimensions in which they lag behind their competitors, especially liquidity and profitability, and to prioritize improvements. Third, the framework is flexible and can be adapted to other industries by adjusting the criteria and expert inputs.

The study also has limitations that should be considered when interpreting its results. The sample is limited to ten companies over a two-year period, which may not capture longer-term performance trends. The criteria weights rely on the subjective judgments of a limited number of experts. In addition, the evaluation is based only on financial ratios and does not consider market-based indicators (such as stock returns or P/E ratios) or non-financial factors. Finally, investment decisions should not be based solely on the results of this study, but should take into account all relevant market conditions and risk considerations.

Future research could extend this work in several directions: (1) using alternative weighting methods, such as the Fuzzy Analytic Network Process (FANP) to account for interdependencies among criteria, or logarithmic fuzzy preference programming (LFPP) to derive more consistent weights; (2) applying other ranking methods, such as VIKOR, PROMETHEE, or fuzzy TOPSIS, and comparing their results with those of this study; (3) conducting a sensitivity analysis to test how robust the rankings are to changes in criteria weights; and (4) extending the analysis to a larger sample of companies, a longer time period, and market-based and non-financial criteria.

Authors' Contributions

All authors read and approved the final manuscript.

Declaration of Generative AI Use

During the preparation of this work, the authors used AI to improve the language and readability of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Declaration of Competing Interests

The authors declare no conflict of interest.

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Ethics Considerations

The financial data used in this study were obtained from publicly available sources, namely the published financial statements of companies listed on the Tehran Stock Exchange. The experts participated voluntarily and gave informed consent, and their identities and individual judgments were kept confidential. As the study involved no intervention and no sensitive personal data, formal ethics committee approval was not sought. All data were used solely for research purposes.

REFERENCES

- [1] Zavadskas, E. K., & Turskis, Z. (2011). Multiple criteria decision making (MCDM) methods in economics: An overview. *Technological and Economic Development of Economy*, 17(2), 397-427. <https://doi.org/10.3846/20294913.2011.593291>
- [2] Balezentis, A., Balezentis, T., & Brauers, W. K. M. (2012). Personnel selection based on computing with words and fuzzy MULTIMOORA. *Expert Systems with Applications*, 39(9), 7961-7967. <https://doi.org/10.1016/j.eswa.2012.01.100>
- [3] Yalcin, N., Bayrakdaroglu, A., & Kahraman, C. (2012). Application of fuzzy multi-criteria decision making methods for financial performance evaluation of Turkish manufacturing industries. *Expert Systems with Applications*, 39(1), 350-364. <https://doi.org/10.1016/j.eswa.2011.07.024>
- [4] Shaverdi, M., Heshmati, M. R., & Ramezani, I. (2014). Application of fuzzy AHP approach for financial performance evaluation of Iranian petrochemical sector. *Procedia Computer Science*, 31, 995-1004. <https://doi.org/10.1016/j.procs.2014.05.352>
- [5] Ban, A. I., Ban, O. I., Bogdan, V., Popa, D. C. S., & Tuse, D. (2020). Performance evaluation model of Romanian manufacturing listed companies by fuzzy AHP and TOPSIS. *Technological and Economic Development of Economy*, 26(4), 808-836. <https://doi.org/10.3846/tede.2020.12367>
- [6] Shaverdi, M., Ramezani, I., Tahmasebi, R., & Anvary Rostamy, A. A. (2016). Combining fuzzy AHP and fuzzy TOPSIS with financial ratios to design a novel performance evaluation model. *International Journal of Fuzzy Systems*, 18(2), 248-262. <https://doi.org/10.1007/s40815-016-0142-8>
- [7] Opricovic, S., & Tzeng, G. H. (2004). Compromise solution by MCDM methods: A comparative analysis of VIKOR and TOPSIS. *European Journal of Operational Research*, 156(2), 445-455. [https://doi.org/10.1016/S0377-2217\(03\)00020-1](https://doi.org/10.1016/S0377-2217(03)00020-1)
- [8] Emamat, M. S. M. M., de Almeida, A. T., Tavana, M., & Mobin, M. (2022). Top companies ranking based on financial ratio with AHP-TOPSIS combined approach and indices of Tehran Stock Exchange. *International Journal of Finance & Economics*. <https://doi.org/10.1002/ijfe.2623>
- [9] Abdel-Basset, M., Ding, W., Mohamed, R., & Metawa, N. (2020). An integrated plithogenic MCDM approach for financial performance evaluation of manufacturing industries. *Risk Management*, 22(3), 192-218. <https://doi.org/10.1057/s41283-020-00061-4>
- [10] Gurusu, A., & Atan, M. (2025). Entropy-based VIKOR and TOPSIS approaches for financial performance ranking: Evidence from Turkish cement companies listed on Borsa Istanbul. *Quality & Quantity*. <https://doi.org/10.1007/s11135-025-02494-z>
- [11] Kagnici, E., Emircan Guleryuz, M., & Ozer, K. (2024). Analysis of financial performance of insurance companies listed on BIST by TOPSIS method. *Journal of Anatolian Cultural Research (JANCR)*, 8(2), 214-230. <https://doi.org/10.15659/jancr.v8i2.189>
- [12] Ghosh, R., & Saima, F. N. (2021). Resilience of commercial banks of Bangladesh to the shocks caused by COVID-19 pandemic: An application of MCDM-based approaches. *Asian Journal of Accounting Research*, 6(3), 281-295. <https://doi.org/10.1108/AJAR-10-2020-0102>
- [13] Business Research Company. (2023). *Plastics and rubber products global market briefing 2023*. MarketResearch.com. Retrieved from <https://www.marketresearch.com/Business-Research-Company-v4006/Plastics-Rubber-Products-Global-Briefing-33140653/>

- [14] AVCI ÖZTÜRK, B., & ÖZÇELİK, F. (2015). Financial Performance Evaluation Of Firms In Bist Chemical Petroleum Plastic Sector By Using An Integrated Multi-Criteria Decision Making Method. *Paradoks: The Journal of Economics, Sociology & Politics*, 11(2).
- [15] Unal, O., & Aktas, R. (2024). A multi-criteria decision-making model for performance analysis in the chemical, pharmaceutical, petroleum, and plastic products sectors traded on Borsa Istanbul. *European Proceedings of Science and Technology (EPSTEM)*. Retrieved from <https://www.epstem.net/index.php/epstem/article/view/1281>
- [16] Nabeeh, N. A., Abdel-Basset, M., El-Ghareeb, H. A., & Aboelfetouh, A. (2023). Decision analysis on the financial performance of companies using integrated entropy-fuzzy TOPSIS model. *Mathematics*, 11(2), 397. <https://doi.org/10.3390/math11020397>
- [17] Kaya, A., Pamucar, D., Gurler, H. E., & Ozcalici, M. (2024). Determining the financial performance of the firms in the Borsa Istanbul sustainability index: Integrating multi-criteria decision making methods. *Financial Innovation*, 10(1), 6. <https://doi.org/10.1186/s40854-024-00704-5>
- [18] Abas, F., Dogu, E., & Basar, A. (2025). Financial performance evaluation of firms in BIST 100 index with ITARA and COBRA methods. *Financial Innovation*, 11(1). <https://doi.org/10.1186/s40854-024-00704-5>
- [19] Türegün, N. (2022). Financial performance evaluation by multi-criteria decision-making techniques. *Heliyon*, 8(5).
- [20] Weston, J. F., Besley, S., & Brigham, E. F. (1996). *Essentials of managerial finance* (11th ed.). Dryden Press.
- [21] Singh, K., & Mathew, M. (2023). Financial performance of Indian NSE-listed companies associated with manufacturing activities: Entropy-based COPRAS approach. *ShodhKosh: Journal of Visual and Performing Arts*, 4(2). <https://doi.org/10.29121/shodhkosh.v4.i2.2023.4091>
- [22] Choudhary, A., Singh, V., & Mehta, P. (2024). Financial performance of Nifty-50 manufacturing companies: An AHP-COPRAS integrated analysis. *ShodhKosh: Journal of Visual and Performing Arts*. <https://doi.org/10.29121/shodhkosh.v5.i1.2024>
- [23] Yataa, G., Ghassan, H. B., & Nour, M. A. I. (2021). Financial performance index of IPO firms using VIKOR-CRITIC techniques. *Finance Research Letters*, 44, 102065. <https://doi.org/10.1016/j.frl.2021.102065>
- [24] Amile, M., Sedaghat, M., & Poorhossein, M. (2013). An integrated fuzzy MCDM approach and analysis to evaluate the financial performance of Iranian cement companies. *The International Journal of Advanced Manufacturing Technology*, 71(1-4). <https://doi.org/10.1007/s00170-013-5370-6>
- [25] Ghaemi-Zadeh, N., & Eghbali-Zarch, M. (2024). Evaluation of business strategies based on the financial performance of the corporation and investors' behavior using D-CRITIC and fuzzy MULTI-MOORA techniques: A real case study. *Expert Systems with Applications*, 247, 123183.
- [26] Sadeghi, O., & Shahabi, A. (2020). A consolidated MCDM framework for overall performance assessment of listed insurance companies based on ranking strategies. *Computational Economics*. <https://doi.org/10.1007/s10614-024-10578-5>
- [27] Karsak, E. E. (2002). Distance-based fuzzy MCDM approach for evaluating flexible manufacturing system alternatives. *International Journal of Production Research* 40(13), 3167-3181. <https://doi.org/10.1080/00207540210146062>
- [28] Zadeh, L. A. (1965). Fuzzy sets. *Information and Control*, 8(3), 338-353. [https://doi.org/10.1016/S0019-9958\(65\)90241-X](https://doi.org/10.1016/S0019-9958(65)90241-X)

- [29] Wang, T. C., & Chang, T. H. (2007). Application of TOPSIS in evaluating initial training aircraft under a fuzzy environment. *Expert Systems with Applications*, 33, 870-880. <https://doi.org/10.1016/j.eswa.2006.07.003>
- [30] Ashtiani, B., Haghighirad, F., Makui, A., and Montazer, G. A. 2008. Extension of fuzzy TOPSIS method based on interval-valued fuzzy sets. *Applied Soft Computing*. <https://doi.org/10.1016/j.asoc.2008.05.005>
- [31] Buyukozkan, G., Feyziog˘lu, O., & Nebol, E. 2007. Selection of the strategic alliance partner in logistics value chain. *International Journal of Production Economics* 113(1), 148-158. <https://doi.org/10.1016/j.ijpe.2007.01.016>
- [32] Chen, C.-T., Lin, C.-T., & Huang, S.-F. 2006. A fuzzy approach for supplier evaluation and selection in supply chain management. *International Journal of Production Economics*, 102(2), 289-301. <https://doi.org/10.1016/j.ijpe.2005.03.009>