Development the Novel FCF-SIWEC-RBNAR Hybrid Method for Financial Performance Evaluation

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Abstract: Financial performance analyses are fundamental tools that provide insights into companies' financial conditions. The primary aim of this study is to develop a financial performance analysis method as a decision support system. In this context, the FCF-SIWEC-RBNAR (*Fermatean Cubic Fuzzy- Simple Weight Calculation- Reference-Based Normalization Alternative Ranking*) hybrid method was developed. In this method, expert weights are determined using FCF sets, while the weights of criteria are calculated using the FCF-SIWEC approach based on expert evaluations. Companies are then ranked according to their financial performance using the RBNAR method. To demonstrate the applicability of the proposed hybrid method, four case studies were conducted using data from 50 companies operating on Borsa Istanbul for the years 2020, 2021, 2022, and 2023. As a result of the research, the "Debt-to-Equity Ratio" was identified as the most significant financial criterion. Additionally, the financial performance rankings of companies were determined for each year. These findings support that the FCF-SIWEC-RBNAR hybrid method is a robust and applicable approach for financial performance evaluation.

1 INTRODUCTION

The most important activities of managers are planning (Snyder & Glueck, 2019), implementation, and control (Alipour et al., 2013; Wu et al., 2005). In carrying out these activities, managers rely on performance reports generated by management accountants. Management accountants, in turn, analyse the financial statements produced by the accounting information system and provide information to users by making these reports applicable to management activities (Hadid & Al-Sayed, 2021; Zhao & Yu, 2025). The standard preparation of the generated information allows for internal comparisons within firms over time and external comparisons with other firms. According to IFRS, which ensures this standard, financial statements include the balance sheet, income statement, and cash flow statement (Lopes & Penela, 2025). These financial statements enable the measurement of a company's liquidity, profitability, debt repayment capacity, and asset efficiency.

The financial statements produced by the accounting information system are used by both internal and external stakeholders in the decision-making process (Tran Thanh Thuy, 2025). The accuracy of decisions relies on making plans with forecasts that ensure the sustainability of firms and on company comparisons (Farshadfar et al., 2025), which are facilitated by reports that are accurate, timely, and tailored to needs. However, simply preparing reports does not help in making accurate decisions; it is also essential to analyse the reports with the correct indicators. Financial ratios are the most important tools in firm performance analysis.

Financial ratios are essential tools used to measure key performance indicators such as liquidity, profitability, debt levels, and operational efficiency of companies. These ratios provide investors, creditors, and company managers with insights into a company's

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financial health while also revealing potential risks and opportunities (Llorent-Jurado et al., 2024). Liquidity ratios assess a company's ability to meet short-term debt obligations, while profitability ratios indicate the efficiency with which a company generates income. Ratios that evaluate debt repayment capacity help in understanding the extent to which a company can sustainably meet its debt obligations.

The accurate calculation and interpretation of financial ratios are crucial for reflecting the true financial condition of a company. However, misinterpretation or manipulation of these ratios can lead to misleading results and conceal the company's actual financial situation. Therefore, financial analyses must be conducted meticulously, and all ratios should be evaluated within their proper context.

Financial ratios play a critical role in evaluating financial performance. In this context, the ratios selected in this study, which are commonly used in the literature, serve as significant indicators for assessing a firm's financial performance. The financial indicators added to the decision-making model in this study include widely used ratios such as Return on Equity (ROE) (Alsanousi et al., 2024; Qureshi et al., 2021; Gutiérrez-Ponce & Wibowo, 2023; Rocha et al., 2024), Return on Assets (ROA) (Loan et al., 2024; Deb et al., 2024; Veeravel et al., 2024), Leverage (Giannopoulos et al., 2022), Debt-to-Equity (Kara et al., 2024; Lam et al., 2023; Abdel-Basset et al., 2020), Operating Profit Margin (Mao, 2024), Pre-tax Profit Margin (Kaya et al., 2024), and Net Profit Margin (Çetin et al., 2024), all of which are instrumental in evaluating a company's profitability, efficiency, and debt repayment capacity.

These indicators enable a comprehensive evaluation in financial analysis, helping us better understand the performance of companies.

Accurately analyzing a company's financial performance is not only crucial for understanding its current financial position but also plays a significant role in evaluating its future growth potential. Financial performance reflects a company's efficiency in obtaining, managing, and utilizing capital, which is one of the key indicators of its financial health during a specific period (Chrysafis, 2024). Regardless of the sector, size, or geographical location, companies must develop strategies based on effective financial performance analysis to sustain long-term success and maintain competitive advantages. In this context, financial analyses are indispensable tools for examining a company's financial condition in-depth and formulating sound strategies for the future. It is also important to remember that financial performance is not limited to profitability; it is deeply intertwined with organizational structures, strategic objectives, and external environmental factors (Khizar et al., 2024). Properly analysing financial performance enables companies to establish a solid foundation when making strategic decisions and contributes to their success in competitive markets. Financial performance analysis is of great importance not only for internal management but also for investors, creditors, and other external stakeholders (Akisik & Gal, 2017).

Financial performance analysis is not only essential for understanding a company's current position but also holds significant value in facilitating the formulation of strategic decisions for the future. In this regard, multi-criteria decision-making (MCDM) methods, employed to assess the financial performance of companies across diverse sectors, enable a comprehensive and detailed analysis of financial data. Tan et al. (2025) employed the SOCP-MCDM method to assess the financial performance of companies, utilizing a robust multi-criteria decision-making framework that accounts for various performance indicators. In a similar vein, Işık et al. (2025) utilized the F-LBWAF-LMAW-MARCOS method, integrating fuzzy logic with multiple decision-making approaches to provide a nuanced analysis of financial health across different firms. These methodologies demonstrate the growing application of advanced techniques in evaluating financial performance, highlighting the need for comprehensive approaches in contemporary business analysis.Özekenci (2024) conducted financial performance analyses using LBWA, MEREC, and CRADIS methods on the BIST Sustainability 25 Index. Alsanousi et al. (2024) performed a financial performance evaluation using BWM and TOPSIS in the Saudi Stock Market. Kaya et al. (2024) ranked the performance of companies in the Borsa Istanbul Sustainability Index by applying FUCOM and Copeland methods. Barutbas et al. (2024) examined the financial performance of companies in the retail sector using DF TOPSIS and fuzzy clustering methods. Ghaemi-Zadeh et al. (2024) utilized D-CRITIC, TOPSIS, and VIKOR methods for financial performance analysis in the Tehran Stock Exchange. Isık et al. (2024) performed financial performance assessments in the insurance sector using PFAHP and MAIRCA methods. Sharma & Kumar (2024) conducted financial performance analysis in the banking sector by employing entropy, TOPSIS, and VIKOR methods. Liou et al. (2024) investigated the effects of COVID-19 in the aviation sector using DEMATEL. Ergülen & Çalik (2024) evaluated financial performance changes during and before the

pandemic in the Turkish industrial sector using F-BWM and MARCOS methods. Kara et al. (2024) applied SVN-CIMAS-CRITIC-RBNAR methods for financial performance evaluations in the Borsa Istanbul Technology sector.

The main motivation of this study is to develop a decision support system for financial performance evaluation and to demonstrate its applicability. In this context, the FCF-SIWEC-RBNAR (*Fermatean Cubic Fuzzy- Simple Weight Calculation- Reference-Based Normalization Alternative Ranking*) hybrid method has been developed. This hybrid method facilitates the identification of experts' influence levels in the decision-making process using FCF (Wang et al., 2024).). It also enables the determination of the weights of criteria (financial ratios) through the FCF-SIWEC method (Puška et al., 2024). Furthermore, it allows for the ranking of companies based on their financial performance using the RBNAR method (Kara et al., 2024). In this study, the financial performance levels of 50 companies operating on Borsa Istanbul for the years 2020, 2021, 2022, and 2023 were determined using the FCF-SIWEC-RBNAR hybrid method.

2 METHODOLOGY

In this study, a hybrid method combining the FCF-SIWEW-RBNAR approach has been developed to evaluate the financial performance of companies. This hybrid method is implemented in three stages. In Stage 1, the weights of the experts determining the importance levels of the criteria are calculated. In Stage 2, the weights of the criteria are determined. Finally, in Stage 3, the companies are ranked based on their financial performance. In the methodology section, the fundamental definitions of FCF are first presented. Subsequently, the steps of the FCF-SIWEC-RBNAR hybrid method are outlined.

2.1 Preliminaries of Fermatean Cubic Fuzzy (FCF) Sets

Definition 1: In the context of the discourse denoted as $\mathfrak{D}$, $\widetilde{\mathfrak{B}}$ is defined as the set $\widetilde{\mathfrak{B}} = \{\langle \mathfrak{d}, [\gamma_{\widetilde{\mathfrak{B}}}^{-}(\mathfrak{d}), \gamma_{\widetilde{\mathfrak{B}}}^{+}(\mathfrak{d})], [\delta_{\widetilde{\mathfrak{B}}}^{-}(\mathfrak{d}), \delta_{\widetilde{\mathfrak{B}}}^{+}(\mathfrak{d})], [\gamma_{\widetilde{\mathfrak{B}}}(\mathfrak{d}), \delta_{\widetilde{\mathfrak{B}}}(\mathfrak{d})] | \mathfrak{d} \in \mathfrak{D}\rangle\}$. This formulation represents a systematically structured collection of FCF sets associated with each element $\mathfrak{d}$ within the set $\mathfrak{D}$. It is crucial to highlight that this function definition is governed by the following constraints: $0 \leq \gamma_{\widetilde{\mathfrak{B}}}^{-}(\mathfrak{d}) + \gamma_{\widetilde{\mathfrak{B}}}^{+}(\mathfrak{d}) \leq 1$ and $0 \leq \delta_{\widetilde{\mathfrak{B}}}^{-}(\mathfrak{d}) + \delta_{\widetilde{\mathfrak{B}}}^{+}(\mathfrak{d}) \leq 1$ and $0 \leq \gamma_{\widetilde{\mathfrak{B}}}(\mathfrak{d}), \delta_{\widetilde{\mathfrak{B}}}(\mathfrak{d}) \leq 1$ and $0 \leq \left(\gamma_{\widetilde{\mathfrak{B}}}^{+}(\mathfrak{d})\right)^3 + \left(\delta_{\widetilde{\mathfrak{B}}}^{+}(\mathfrak{d})\right)^3 \leq 1$ and $0 \leq \left(\gamma_{\widetilde{\mathfrak{B}}}(\mathfrak{d})\right)^3 + \left(\delta_{\widetilde{\mathfrak{B}}}(\mathfrak{d})\right)^3 \leq 1$ and for each element q, in the set Q (Wang et al., 2024).

Definition 2: Consider $\widetilde{\mathfrak{B}}_1 = \{\langle \mathfrak{d}, [\gamma_{\widetilde{\mathfrak{B}}_1}^{-}(\mathfrak{d}), \gamma_{\widetilde{\mathfrak{B}}_1}^{+}(\mathfrak{d})], [\delta_{\widetilde{\mathfrak{B}}_1}^{-}(\mathfrak{d}), \delta_{\widetilde{\mathfrak{B}}_1}^{+}(\mathfrak{d})], [\gamma_{\widetilde{\mathfrak{B}}_1}(\mathfrak{d}), \delta_{\widetilde{\mathfrak{B}}_1}(\mathfrak{d})] | \mathfrak{d} \in \mathfrak{D}\rangle\}$ is FCF set related to each element $\mathfrak{d}$ within set $\mathfrak{D}$. The score function $Sc(\widetilde{\mathfrak{B}}_1)$ can be calculated by employing Eq. (1) (Wang et al., 2024).

$$Sc(\widetilde{\mathfrak{B}}_1) = \frac{1}{2}\left[\left(\frac{1}{4}\left(\left(\gamma_{\widetilde{\mathfrak{B}}_1}^{-}(\mathfrak{d})\right)^3 + \left(\gamma_{\widetilde{\mathfrak{B}}_1}^{+}(\mathfrak{d})\right)^3 - \left(\delta_{\widetilde{\mathfrak{B}}_1}^{-}(\mathfrak{d})\right)^3 - \left(\delta_{\widetilde{\mathfrak{B}}_1}^{+}(\mathfrak{d})\right)^3\right)\right) + \left(\frac{1}{2}\left(\left(\gamma_{\widetilde{\mathfrak{B}}_1}(\mathfrak{d})\right)^3 - \left(\delta_{\widetilde{\mathfrak{B}}_1}(\mathfrak{d})\right)^3\right)\right) + 1\right]. \quad (1)$$

2.2 The FCF-SIWEC-RBNAR Hybrid Method

The FCF-SIWEC-RBNAR hybrid method is developed to evaluate the financial performance of companies. Let $\exists = \{\exists_1, \exists_2, \dots, \exists_k, \dots, \exists_K\}$ $(k = 1,2,\dots,K)$ shows the experts, $\wp = \{\wp_1, \wp_2, \dots, \wp_j, \dots, \wp_J\}$ $(j = 1,2,\dots,J)$ shows the criteria and $\mathring{A} = \{\mathring{A}_1, \mathring{A}_2, \dots, \mathring{A}_i, \dots, \mathring{A}_I\}$ $(i = 1,2,\dots,I)$ shows the alternatives (companies). The FCF-SIWEC-RBNAR hybrid method consists of three stages, with the steps of the method detailed as follows:

Stage 1: *Establishing the expert weighting matrix using FCF sets*:

Step 1-1: The expertise levels of the experts are determined using linguistics variables (LVs) shown in Table 1. Subsequently, LVs are converted to FCF numbers. Therefore, the experts assessment matrix $\left(\tilde{\mathcal{S}} = [\tilde{\mathcal{S}}_k]_K\right)$ can be determined.

Table 1: The LVs for expertise level (Wang et al., 2024).

LVs	*FCF Numbers*
Very High (VH)	[0.80,0.85], [0.20,0.25], [0.75,0.25]
High (H)	[0.70,0.75], [0.30,0.35], [0.65,0.35]
Medium (M)	[0.50,0.55], [0.40,0.45], [0.50,0.45]
Low (L)	[0.30,0.35], [0.70,0.75], [0.35,0.65]
Very Low (VH)	[0.20,0.25], [0.80,0.85], [0.25,0.75]

Step 1-2: FCF numbers are transformed to crisp values using the score function shown in Eq. (2). Therefore, the score function matrix $(\mathcal{S} = [\mathcal{S}_k]_K)$ can be calculated.

$$\mathcal{S}_k = Sc(\tilde{\mathcal{S}}_k) = \frac{1}{2}\left[\left(\frac{1}{4}\left(\left(\gamma_{\tilde{\mathcal{S}}_k}^{-}(\mathfrak{d})\right)^3 + \left(\gamma_{\tilde{\mathcal{S}}_k}^{+}(\mathfrak{d})\right)^3 - \left(\delta_{\tilde{\mathcal{S}}_k}^{-}(\mathfrak{d})\right)^3 - \left(\delta_{\tilde{\mathcal{S}}_k}^{+}(\mathfrak{d})\right)^3\right)\right) + \left(\frac{1}{2}\left(\left(\gamma_{\tilde{\mathcal{S}}_k}(\mathfrak{d})\right)^3 - \left(\delta_{\tilde{\mathcal{S}}_k}(\mathfrak{d})\right)^3\right)\right) + 1\right]. \quad (2)$$

Step 1-3: The weighting of the experts is computed using Eq. (3). Therefore, the experts weighting matrix ($w = [w_k]_K$) can be determined.

$$w_k = \frac{s_k}{\sum_{k=1}^{K} s_k}; (k = 1,2, \dots, K). \quad (3)$$

herein, $w_k \in [0,1]$ and $\sum_{k=1}^{K} w_k = 1$.

Stage 2: *Establishing the criteria weighting matrix using the FCF-SIWEC method (*Puška et al., 2024*)*:

Step 2-1: Each expert assesses each criterion using the LVs provided in Table 2. Subsequently, LVs are converted to FCF numbers. Therefore, the criteria assessment matrix $\left(\tilde{Q} = [\tilde{Q}_{jk}]_{JxK}\right)$ can be determined. Herein,

$$\tilde{Q}_{jk} = \left\{ \begin{matrix} \mathfrak{d}, \left[\gamma_{\tilde{Q}_{jk}}^{-}(\mathfrak{d}), \gamma_{\tilde{Q}_{jk}}^{+}(\mathfrak{d})\right], \\ \left\langle \left[\delta_{\tilde{Q}_{jk}}^{-}(\mathfrak{d}), \delta_{\tilde{Q}_{jk}}^{+}(\mathfrak{d})\right], \left[\gamma_{\tilde{Q}_{jk}}(\mathfrak{d}), \delta_{\tilde{Q}_{jk}}(\mathfrak{d})\right] \right| \mathfrak{d} \in \mathfrak{D} \right\rangle \end{matrix} \right\}.$$

Table 2: The LVs for criteria evaluation (Wang et al., 2024).

LVs	*FCF Numbers*
Extremely High (EH)	[0.90,0.95], [0.10,0.15], [0.85,0.15]
Very High (VH)	[0.80,0.85], [0.20,0.25], [0.75,0.25]
High (H)	[0.70,0.75], [0.30,0.35], [0.65,0.35]
Medium (M)	[0.50,0.55], [0.40,0.45], [0.50,0.45]
Low (L)	[0.30,0.35], [0.70,0.75], [0.35,0.65]
Very Low (VH)	[0.20,0.25], [0.80,0.85], [0.25,0.75]
Extremely Low (EL)	[0.10,0.15], [0.90,0.95], [0.15,0.85]

Step 2-2: The criteria assessment matrix is multiplied by the experts' weights using Eq. (4). Therefore, the weighted criteria assessment matrix $\left(\tilde{\mathcal{P}} = [\tilde{\mathcal{P}}_{jk}]_{JxK}\right)$ can be determined.

$$\tilde{\mathcal{P}}_{jk} = w_k \tilde{Q}_{jk} = \left\{ \begin{matrix} \left[\sqrt[3]{1 - \left(\left(1 - \left(\gamma_{\tilde{Q}_{jk}}^{-}(\mathfrak{d})\right)^3\right)\right)^{w_k}}, \right. \\ \left. \sqrt[3]{1 - \left(\left(1 - \left(\gamma_{\tilde{Q}_{jk}}^{+}(\mathfrak{d})\right)^3\right)\right)^{w_k}} \right], \\ \left\langle \begin{matrix} \left[\left(\delta_{\tilde{Q}_{jk}}^{-}(\mathfrak{d})\right)^{w_k}, \right. \\ \left. \left(\delta_{\tilde{Q}_{jk}}^{+}(\mathfrak{d})\right)^{w_k} \right], \end{matrix} \right. \\ \left[\begin{matrix} \left(\gamma_{\tilde{Q}_{jk}}(\mathfrak{d})\right)^{w_k}, \\ \sqrt[3]{1 - \left(\left(1 - \left(\delta_{\tilde{Q}_{jk}}(\mathfrak{d})\right)^3\right)\right)^{w_k}} \end{matrix} \right] \end{matrix} \right\}. \quad (4)$$

Step 2-3: FCF numbers are transformed to crisp values using score function shown in Eq. (2). Therefore, the crisp criteria assessment matrix $\left(\mathcal{P} = [\mathcal{P}_{jk}]_{JxK}\right)$ can be calculated.

Step 2-4: The normalized criteria - matrix $\left(\mathcal{O} = [\mathcal{O}_{jk}]_{JxK}\right)$ can be calculated using Eq. (5).

$$\mathcal{O}_{jk} = \frac{\mathcal{P}_{jk}}{\max\limits_{1 \le j \le J} \mathcal{P}_{jk}}; (j = 1, \dots, J;\ k = 1, \dots, K). \quad (5)$$

Step 2-5: The standardized criteria assessment matrix $\left(\mathcal{N} = [\mathcal{N}_{jk}]_{JxK}\right)$ can be calculated using Eq. (6).

$$\mathcal{N}_{jk} = \mathcal{O}_{jk}\sigma_j;\ (j = 1, \dots, J;\ k = 1, \dots, K). \quad (6)$$

herein, σ_j refers the standard deviation of each criterion.

Step 2-6: The sum of the weighting matrix $\left(\mathcal{M} = [\mathcal{M}_j]_J\right)$ can be calculated using Eq. (7).

$$\mathcal{M}_j = \sum_{k=1}^{K} \mathcal{N}_{jk};\ (j = 1, \dots, J;\ k = 1, \dots, K). \quad (7)$$

Step 2-7: The criteria weighting matrix $\left(\mathbb{w} = [\mathbb{w}_j]_J\right)$ can be computed using Eq. (8).

$$\mathbb{w}_j = \frac{\mathcal{M}_j}{\sum_{j=1}^{J} \mathcal{M}_j};\ (j = 1, \dots, J). \quad (8)$$

herein, $\mathbb{w} = (\mathbb{w}_1, \mathbb{w}_2, \dots, \mathbb{w}_j, \dots, \mathbb{w}_J)$ for $\mathbb{w}_j \in [0,1]$ with the $\sum_{j=1}^{J} \mathbb{w}_j = 1$.

Stage 3: *Evaluating the financial performance of companies using the RBNAR method*:

Step 3-1: The RBNAR method consist of two distinct normalization processes (Kara et al., 2024). These are the Z-score normalization technique (Shih et al., 2007) and Aytekin's reference-based normalization technique (Aytekin, 2020). Then, these two normalization can be aggregated with Heron Mean (Zhu, 2022). Initially, the initial decision matrix $\left(\mathcal{L} = [L_{ij}]_{IxJ}\right)$ is constructed. In this step, there are three sub-steps:

Step 3-1a: The first normalized matrix $\left(\mathcal{K} = [\mathcal{K}_{ij}]_{IxJ}\right)$ is computed using Eq. (9).

$$\mathcal{K}_{ij} = e^{\left(\frac{(L_{ij} - R_j)^2}{-2(\sigma_j)^2}\right)};\ (i = 1, \dots, I; j = 1, \dots, J). \quad (9)$$

herein, R_j indicates reference value matrix and σ_j refers the standard deviation of each criterion.

Step 3-1b: The second normalized matrix $\left(\mathcal{H} = [\mathcal{H}_{ij}]_{IxJ}\right)$ is computed using Eq. (10).

$$\mathcal{K}_{ij} = 1 - \frac{|L_{ij} - R_j|}{|R_j| + 10^{\alpha}};\ (i = 1, \dots, I; j = 1, \dots, J). \quad (10)$$

herein, R_j indicates reference value matrix and α refers a positive value.

Step 3-1c: The aggregated normalized matrix $\left(\mathcal{G} = [\mathcal{G}_{ij}]_{IxJ}\right)$ is computed using Eq. (11).

$$\mathcal{G}_{ij} = \xi\sqrt{\mathcal{K}_{ij}\mathcal{G}_{ij}} + (1 - \xi)\frac{\mathcal{K}_{ij} + \mathcal{G}_{ij}}{2};\ (i = 1, \dots, I; j = 1, \dots, J). \quad (11)$$

herein, ξ indicates trade-off parameter for determining weighting of first normalization technique.

Step 3-2: The weighted normalized matrix $\left(\mathcal{F} = [\mathcal{F}_{ij}]_{IxJ}\right)$ is computed using Eq. (11).

$$\mathcal{F}_{ij} = \mathbb{w}_j\mathcal{G}_{ij};\ (i = 1, \dots, I; j = 1, \dots, J). \quad (11)$$

Step 3-3: The alternative ranking matrix ($\mathcal{R} = [\mathcal{R}_i]_I$) is computed using Eq. (12).

$$\mathcal{R}_i = \sum_{j=1}^{J} \mathcal{F}_{ij}\ ;\ (i = 1, \dots, I; j = 1, \dots, J). \quad (12)$$

3 APPLICATIONS

In this study, the financial performance of 50 companies was evaluated for the years 2020, 2021, 2022, and 2023 using the FCF-SIWEC-RBNAR hybrid method. In the application section, information about the experts is first presented, and the criteria are explained. Subsequently, the applications of the FCF-SIWEC-RBNAR hybrid method for each year are demonstrated.

3.1 Experts and Criteria

3.1.1 Experts

To determine the importance levels of the criteria, the opinions of 8 experts were sought. These experts consist of financial managers from companies and academics conducting research in the field of finance. Information about the experts is provided in Table 3. Face-to-face interviews were conducted to gather expert evaluations. During this process, the expert evaluation matrix, which reflects the expertise levels of the experts, and the criteria evaluation matrix, which indicates the importance levels of the criteria, were obtained.

Table 3: Experts Group.

Experts	*Expertise Level*	*Professions*
$\exists_1$	High (H)	Financial Manager
$\exists_2$	High (H)	Financial Manager
$\exists_3$	Very High (VH)	Financial Manager
$\exists_4$	High (H)	Financial Manager
$\exists_5$	Medium (M)	Professor of Finance
$\exists_6$	Very High (VH)	Professor of Finance
$\exists_7$	Very High (VH)	Professor of Finance
$\exists_8$	Medium (M)	Professor of Finance

3.1.2 Criteria

Seven criteria were identified to evaluate the financial performance of companies. These criteria consist of financial ratios, which serve as key indicators of a company's financial condition. The financial ratios used in the study are presented in Table 4. The financial ratio values of the companies were calculated based on data obtained from financial reports. Consequently, the initial decision matrices for financial performance evaluation were established for each year.

Table 4: Financial Ratios as Criteria.

Criteria	*Identification*
$\wp_1$	Equity Profitability Ratio
$\wp_2$	Return on Assets (ROA) Ratio
$\wp_3$	Leverage Ratio
$\wp_4$	Debt-to-Equity Ratio
$\wp_5$	Operating Profit Margin
$\wp_6$	Pre-tax Profit Margin
$\wp_7$	Net Profit Margin

3.2 Application-1: Assessment of Financial Performance for 2020

The steps of the FCF-SIWEC-RBNAR hybrid method for calculating the financial performance of the selected companies were applied in the following sequence:

Application-1 Stage 1: *Establishing the expert weighting matrix using FCF sets*:

Step 1-1: The experts assessment matrix $\left(\tilde{\mathcal{S}} = \left[\tilde{\mathcal{S}}_k\right]_K\right)$ were determined. It is shown in Table 5.

Table 5: The experts assessment matrix.

Expert	*LVs*	*FCF Numbers*	$\mathcal{S}_k$
$\exists_1$	H	[0.70,0.75], [0.30,0.35], [0.65,0.35]	0.6448
$\exists_2$	H	[0.70,0.75], [0.30,0.35], [0.65,0.35]	0.6448
$\exists_3$	VH	[0.80,0.85], [0.20,0.25], [0.75,0.25]	0.7394
$\exists_4$	H	[0.70,0.75], [0.30,0.35], [0.65,0.35]	0.6448
$\exists_5$	M	[0.50,0.55], [0.40,0.45], [0.50,0.45]	0.5255
$\exists_6$	VH	[0.80,0.85], [0.20,0.25], [0.75,0.25]	0.7394
$\exists_7$	VH	[0.80,0.85], [0.20,0.25], [0.75,0.25]	0.7394
$\exists_8$	M	[0.50,0.55], [0.40,0.45], [0.50,0.45]	0.5255

Step 1-2: The score function matrix ($\mathcal{S} = [\mathcal{S}_k]_K$) were calculated using Eq. (2). It is shown in Table 5.

Step 1-3: The experts weighting matrix ($w = [w_k]_K$) were calculated using Eq. (3). It is shown in Table 6.

Table 6: The experts weighting matrix.

	$\exists_1$	$\exists_2$	$\exists_3$	$\exists_4$	$\exists_5$	$\exists_6$	$\exists_7$	$\exists_8$
w_k	0.1239	0.1239	0.1421	0.1239	0.1010	0.1421	0.1421	0.1010

Application-1 Stage 2: *Establishing the criteria weighting matrix using the FCF-SIWEC method*:

Step 2-1: The criteria assessment matrix $\left(\tilde{\mathcal{Q}} = \left[\tilde{\mathcal{Q}}_{jk}\right]_{JxK}\right)$ were determined. It is shown in Table 7.

Step 2-2: The weighted criteria assessment matrix $\left(\tilde{\mathcal{P}} = \left[\tilde{\mathcal{P}}_{jk}\right]_{JxK}\right)$ were determined using Eq. (4).

Step 2-3: The crisp criteria assessment matrix $\left(\mathcal{P} = \left[\mathcal{P}_{jk}\right]_{JxK}\right)$ can be computed by employing Eq. (2).

Table 7: The criteria assessment matrix.

	$\wp_1$	$\wp_2$	$\wp_3$	$\wp_4$	$\wp_5$	$\wp_6$	$\wp_7$
$\exists_1$	M	L	M	H	M	H	M
$\exists_2$	H	H	M	H	M	EH	H
$\exists_3$	M	M	L	H	M	VH	H
$\exists_4$	H	VH	H	VH	H	H	M
$\exists_5$	M	M	L	M	M	M	L
$\exists_6$	EH	VH	EH	EH	VH	EH	H
$\exists_7$	M	H	M	H	VH	VH	H
$\exists_8$	VH	H	VH	M	VH	VH	H

Step 2-4: The normalized criteria assessment matrix $\left(\mathcal{O} = [\mathcal{O}_{jk}]_{JxK}\right)$ were computed using Eq. (5).

Step 2-5: The standardized criteria assessment matrix $\left(\mathcal{N} = [\mathcal{N}_{jk}]_{JxK}\right)$ were computed using Eq. (6).

Step 2-6: The sum of the weighting matrix $\left(\mathcal{M} = [\mathcal{M}_j]_J\right)$ were computed using Eq. (7).

Step 2-7: The criteria weighting matrix $\left(\mathbb{w} = [\mathbb{w}_j]_J\right)$ were computed using Eq. (8). It is shown in Table 8.

Table 8: The criteria weighting matrix.

	$\wp_1$	$\wp_2$	$\wp_3$	$\wp_4$	$\wp_5$	$\wp_6$	$\wp_7$
$\mathbb{w}_j$	0.1426	0.1362	0.1453	0.1464	0.1429	0.1428	0.1438

Application-1 Stage 3: *Evaluating the financial performance of companies using the RBNAR method*:

Step 3-1: The initial decision matrix $\left(\mathcal{L} = [L_{ij}]_{IxJ}\right)$ was constructed.

Step 3-1a: The first normalized matrix $\left(\mathcal{K} = [\mathcal{K}_{ij}]_{IxJ}\right)$ were computed using Eq. (9).

Step 3-1b: The second normalized matrix $\left(\mathcal{H} = [\mathcal{H}_{ij}]_{IxJ}\right)$ were computed using Eq. (10). Herein, references values for each criterion (R_j) were determined depending on sectoral avarage. It is shown in Table 9. α was also determined as 6.

Table 9: The references values for 2020.

	$\wp_1$	$\wp_2$	$\wp_3$	$\wp_4$	$\wp_5$	$\wp_6$	$\wp_7$
R_j	-0.07	0.07	0.58	11.65	24.37	20.37	17.52

Step 3-1c: The aggregated normalized matrix $\left(\mathcal{G} = [\mathcal{G}_{ij}]_{IxJ}\right)$ were computed using Eq.(11) ($\xi = 0.5$)

Step 3-2: The weighted normalized matrix $\left(\mathcal{F} = [\mathcal{F}_{ij}]_{IxJ}\right)$ were computed by employing Eq. (11).

Step 3-3: The alternative ranking matrix ($\mathcal{R} = [\mathcal{R}_i]_I$) were computed using Eq. (12). It is shown in Table 10.

Table 10: The alternative ranking matrix (2020).

Alt.	*Company*	$\mathcal{R}_i$	Rank
$Å_1$	AEFES	0.962562	19
$Å_2$	AKCNS	0.984732	10
$Å_3$	AKSA	0.992541	3
$Å_4$	AKSEN	0.986193	8
$Å_5$	ARCLK	0.979713	14
$Å_6$	ASELS	0.962279	20
$Å_7$	BFREN	0.932081	31
$Å_8$	BIMAS	0.970206	17
$Å_9$	BRSAN	0.948489	25
$Å_{10}$	BRYAT	0.588302	50
$Å_{11}$	BTCIM	0.814295	46
$Å_{12}$	CCOLA	0.985611	9
$Å_{13}$	CIMSA	0.988697	5
$Å_{14}$	DOAS	0.942514	28
$Å_{15}$	ECILC	0.907017	39
$Å_{16}$	EGEEN	0.829042	44
$Å_{17}$	ENJSA	0.982585	12
$Å_{18}$	ENKAI	0.927217	32
$Å_{19}$	EREGL	0.950851	23
$Å_{20}$	FROTO	0.918203	37
$Å_{21}$	GUBRF	0.991015	4
$Å_{22}$	HEKTS	0.979841	13
$Å_{23}$	IPEKE	0.827259	45
$Å_{24}$	ISMEN	0.925188	33
$Å_{25}$	KONTR	0.997134	1
$Å_{26}$	KONYA	0.923407	34
$Å_{27}$	KOZAA	0.829462	43
$Å_{28}$	KOZAL	0.735799	48
$Å_{29}$	KRDMD	0.963375	18
$Å_{30}$	MGROS	0.666527	49
$Å_{31}$	ODAS	0.867859	42
$Å_{32}$	OTKAR	0.918612	36
$Å_{33}$	OYAKC	0.976441	15
$Å_{34}$	PETKM	0.988252	6
$Å_{35}$	PGSUS	0.759200	47
$Å_{36}$	SASA	0.970442	16
$Å_{37}$	SAYAS	0.954227	22
$Å_{38}$	SISE	0.933951	30
$Å_{39}$	SOKM	0.909599	38
$Å_{40}$	TCELL	0.943898	27
$Å_{41}$	THYAO	0.887813	40
$Å_{42}$	TOASO	0.958634	21
$Å_{43}$	TTKOM	0.946221	26
$Å_{44}$	TTRAK	0.937094	29
$Å_{45}$	TUKAS	0.986323	7
$Å_{46}$	TUPRS	0.874764	41
$Å_{47}$	ULKER	0.994155	2
$Å_{48}$	VESBE	0.948991	24
$Å_{49}$	VESTL	0.982698	11
$Å_{50}$	ZOREN	0.921379	35

3.3 Application-2: Assessment of Financial Performance for 2021

In Application 1, the expert weights and criteria weights calculated are used in the same manner to determine the financial performance of the selected companies for the year 2021. Therefore, starting from Stage 3, this application was completed as Application 2:

Application-2 Stage 3: *Evaluating the financial performance of companies using the RBNAR method*:

Step 3-1: The initial decision matrix $\left(\mathcal{L} = \left[L_{ij}\right]_{IxJ}\right)$ was constructed.

Step 3-1a: The first normalized matrix $\left(\mathcal{K} = \left[\mathcal{K}_{ij}\right]_{IxJ}\right)$ were computed using Eq. (9).

Step 3-1b: The second normalized matrix $\left(\mathcal{H} = \left[\mathcal{H}_{ij}\right]_{IxJ}\right)$ were computed using Eq. (10). Herein, references values for each criterion $\left(R_j\right)$ were determined depending on sectoral avarage. It is shown in Table 11. α was also determined as 6.

Table 11: The references values for 2021.

	$\wp_1$	$\wp_2$	$\wp_3$	$\wp_4$	$\wp_5$	$\wp_6$	$\wp_7$
R_j	0.26	0.10	0.58	2.90	26.16	27.85	25.18

Step 3-1c: The aggregated normalized matrix $\left(\mathcal{G} = \left[\mathcal{G}_{ij}\right]_{IxJ}\right)$ were computed using Eq.(11) $(\xi = 0.5)$

Step 3-2: The weighted normalized matrix $\left(\mathcal{F} = \left[\mathcal{F}_{ij}\right]_{IxJ}\right)$ were computed by employing Eq. (11).

Step 3-3: The alternative ranking matrix $(\mathcal{R} = [\mathcal{R}_i]_I)$ were computed using Eq. (12). It is shown in Table 12.

3.4 Application-3: Assessment of Financial Performance for 2022

In Application 1, the expert weights and criteria weights calculated are used in the same manner to determine the financial performance of the selected companies for the year 2022. Therefore, starting from Stage 3, this application was completed as Application 2:

Application-3 Stage 3: *Evaluating the financial performance of companies using the RBNAR method*:

Step 3-1: The initial decision matrix $(\mathcal{L} = \left[L_{ij}\right]_{IxJ})$ was constructed.

Step 3-1a: The first normalized matrix $\left(\mathcal{K} = \left[\mathcal{K}_{ij}\right]_{IxJ}\right)$ were computed using Eq. (9).

le 12: The alternative ranking matrix (2021).

Alt.	*Company*	$\mathcal{R}_i$	Rank
$Å_1$	AEFES	0.932210	23
$Å_2$	AKCNS	0.976393	5
$Å_3$	AKSA	0.972999	7
$Å_4$	AKSEN	0.967961	8
$Å_5$	ARCLK	0.955702	17
$Å_6$	ASELS	0.965635	12
$Å_7$	BFREN	0.904064	33
$Å_8$	BIMAS	0.965993	11
$Å_9$	BRSAN	0.906092	32
$Å_{10}$	BRYAT	0.549874	50
$Å_{11}$	BTCIM	0.745476	47
$Å_{12}$	CCOLA	0.975334	6
$Å_{13}$	CIMSA	0.947578	18
$Å_{14}$	DOAS	0.896664	34
$Å_{15}$	ECILC	0.871806	38
$Å_{16}$	EGEEN	0.761759	44
$Å_{17}$	ENJSA	0.984248	2
$Å_{18}$	ENKAI	0.910959	29
$Å_{19}$	EREGL	0.939049	22
$Å_{20}$	FROTO	0.846560	41
$Å_{21}$	GUBRF	0.966433	10
$Å_{22}$	HEKTS	0.977750	4
$Å_{23}$	IPEKE	0.795278	43
$Å_{24}$	ISMEN	0.909414	30
$Å_{25}$	KONTR	0.966620	9
$Å_{26}$	KONYA	0.918015	26
$Å_{27}$	KOZAA	0.811229	42
$Å_{28}$	KOZAL	0.747146	46
$Å_{29}$	KRDMD	0.963214	13
$Å_{30}$	MGROS	0.739880	48
$Å_{31}$	ODAS	0.923764	25
$Å_{32}$	OTKAR	0.885828	36
$Å_{33}$	OYAKC	0.961425	15
$Å_{34}$	PETKM	0.960577	16
$Å_{35}$	PGSUS	0.739281	49
$Å_{36}$	SASA	0.939096	21
$Å_{37}$	SAYAS	0.849308	40
$Å_{38}$	SISE	0.908288	31
$Å_{39}$	SOKM	0.759649	45
$Å_{40}$	TCELL	0.915811	27
$Å_{41}$	THYAO	0.946889	19
$Å_{42}$	TOASO	0.927396	24
$Å_{43}$	TTKOM	0.940303	20
$Å_{44}$	TTRAK	0.893256	35
$Å_{45}$	TUKAS	0.990163	1
$Å_{46}$	TUPRS	0.912764	28
$Å_{47}$	ULKER	0.861023	39
$Å_{48}$	VESBE	0.978342	3
$Å_{49}$	VESTL	0.962218	14
$Å_{50}$	ZOREN	0.880782	37

Step 3-1b: The second normalized matrix $\left(\mathcal{H} = \left[\mathcal{H}_{ij}\right]_{IxJ}\right)$ were computed using Eq. (10). Herein, references values for each criterion $\left(R_j\right)$ were determined depending on sectoral avarage. It is shown in Table 13. α was also determined as 6.

Table 13: The references values for 2022.

	$\wp_1$	$\wp_2$	$\wp_3$	$\wp_4$	$\wp_5$	$\wp_6$	$\wp_7$
R_j	0.20	0.09	0.51	1.38	22.57	18.68	19.23

Step 3-1c: The aggregated normalized matrix $\left(\mathcal{G} = [\mathcal{G}_{ij}]_{IxJ}\right)$ were computed using Eq.(11) ($\xi = 0.5$)

Step 3-2: The weighted normalized matrix $\left(\mathcal{F} = [\mathcal{F}_{ij}]_{IxJ}\right)$ were computed by employing Eq. (11).

Step 3-3: The alternative ranking matrix ($\mathcal{R} = [\mathcal{R}_i]_I$) were computed using Eq. (12). It is shown in Table 14.

Table 14: The alternative ranking matrix (2022).

Alt.	*Company*	$\mathcal{R}_i$	Rank
$Ă_1$	AEFES	0.964933	6
$Ă_2$	AKCNS	0.942071	12
$Ă_3$	AKSA	0.913490	25
$Ă_4$	AKSEN	0.958796	8
$Ă_5$	ARCLK	0.860952	35
$Ă_6$	ASELS	0.917481	23
$Ă_7$	BFREN	0.913014	26
$Ă_8$	BIMAS	0.970948	2
$Ă_9$	BRSAN	0.970224	3
$Ă_{10}$	BRYAT	0.525771	50
$Ă_{11}$	BTCIM	0.945333	11
$Ă_{12}$	CCOLA	0.971074	1
$Ă_{13}$	CIMSA	0.966093	5
$Ă_{14}$	DOAS	0.804489	44
$Ă_{15}$	ECILC	0.805849	43
$Ă_{16}$	EGEEN	0.954799	9
$Ă_{17}$	ENJSA	0.938734	14
$Ă_{18}$	ENKAI	0.853206	36
$Ă_{19}$	EREGL	0.938701	15
$Ă_{20}$	FROTO	0.821838	42
$Ă_{21}$	GUBRF	0.920006	22
$Ă_{22}$	HEKTS	0.959673	7
$Ă_{23}$	IPEKE	0.690894	47
$Ă_{24}$	ISMEN	0.786546	46
$Ă_{25}$	KONTR	0.936900	16
$Ă_{26}$	KONYA	0.931840	18
$Ă_{27}$	KOZAA	0.662415	48
$Ă_{28}$	KOZAL	0.607810	49
$Ă_{29}$	KRDMD	0.906280	28
$Ă_{30}$	MGROS	0.941262	13
$Ă_{31}$	ODAS	0.913916	24
$Ă_{32}$	OTKAR	0.873978	32
$Ă_{33}$	OYAKC	0.861374	33
$Ă_{34}$	PETKM	0.861179	34
$Ă_{35}$	PGSUS	0.800734	45
$Ă_{36}$	SASA	0.850716	38
$Ă_{37}$	SAYAS	0.890156	30
$Ă_{38}$	SISE	0.910982	27
$Ă_{39}$	SOKM	0.932444	17
$Ă_{40}$	TCELL	0.899292	29
$Ă_{41}$	THYAO	0.946571	10
$Ă_{42}$	TOASO	0.925703	19
$Ă_{43}$	TTKOM	0.968590	4
$Ă_{44}$	TTRAK	0.887566	31
$Ă_{45}$	TUKAS	0.849450	39
$Ă_{46}$	TUPRS	0.925084	20
$Ă_{47}$	ULKER	0.832743	41
$Ă_{48}$	VESBE	0.852768	37
$Ă_{49}$	VESTL	0.833815	40
$Ă_{50}$	ZOREN	0.920313	21

3.5 Application-4: Assessment of Financial Performance for 2023

In Application 1, the expert weights and criteria weights calculated are used in the same manner to determine the financial performance of the selected companies for the year 2023. Therefore, starting from Stage 3, this application was completed as Application 2:

Application-3 Stage 3: *Evaluating the financial performance of companies using the RBNAR method*:

Step 3-1: The initial decision matrix $\left(\mathcal{L} = [L_{ij}]_{IxJ}\right)$ was constructed.

Step 3-1a: The first normalized matrix $\left(\mathcal{K} = [\mathcal{K}_{ij}]_{IxJ}\right)$ were computed using Eq. (9).

Step 3-1b: The second normalized matrix $\left(\mathcal{H} = [\mathcal{H}_{ij}]_{IxJ}\right)$ were computed using Eq. (10). Herein, references values for each criterion $\left(R_j\right)$ were determined depending on sectoral avarage. It is shown in Table 15. α was also determined as 6.

Table 15: The references values for 2023.

	$\wp_1$	$\wp_2$	$\wp_3$	$\wp_4$	$\wp_5$	$\wp_6$	$\wp_7$
R_j	0.18	0.09	0.46	1.14	21.62	37.77	39.88

Step 3-1c: The aggregated normalized matrix $\left(\mathcal{G} = [\mathcal{G}_{ij}]_{IxJ}\right)$ were computed using Eq.(11)($\xi = 0.5$).

Step 3-2: The weighted normalized matrix $\left(\mathcal{F} = [\mathcal{F}_{ij}]_{IxJ}\right)$ were computed by employing Eq. (11).

Step 3-3: The alternative ranking matrix ($\mathcal{R} = [\mathcal{R}_i]_I$) were computed using Eq. (12). It is shown in Table 16.

Table 16: The alternative ranking matrix (2023).

Alt.	*Company*	$\mathcal{R}_i$	Rank
$Ă_1$	AEFES	0.965852	10
$Ă_2$	AKCNS	0.951164	17
$Ă_3$	AKSA	0.952919	15
$Ă_4$	AKSEN	0.981123	4
$Ă_5$	ARCLK	0.814969	43
$Ă_6$	ASELS	0.964276	13
$Ă_7$	BFREN	0.590641	49
$Ă_8$	BIMAS	0.984929	2

Table 16: The alternative ranking matrix (2023) (cont.).

Alt.	*Company*	$\mathcal{R}_i$	Rank
Ă$_9$	BRSAN	0.983916	3
Ă$_{10}$	BRYAT	0.545945	50
Ă$_{11}$	BTCIM	0.974750	7
Ă$_{12}$	CCOLA	0.864660	37
Ă$_{13}$	CIMSA	0.974084	8
Ă$_{14}$	DOAS	0.834484	41
Ă$_{15}$	ECILC	0.887644	35
Ă$_{16}$	EGEEN	0.961861	14
Ă$_{17}$	ENJSA	0.952794	16
Ă$_{18}$	ENKAI	0.910901	27
Ă$_{19}$	EREGL	0.908386	29
Ă$_{20}$	FROTO	0.770342	48
Ă$_{21}$	GUBRF	0.896613	32
Ă$_{22}$	HEKTS	0.771871	47
Ă$_{23}$	IPEKE	0.792363	45
Ă$_{24}$	ISMEN	0.910019	28
Ă$_{25}$	KONTR	0.892299	34
Ă$_{26}$	KONYA	0.912007	25
Ă$_{27}$	KOZAA	0.798384	44
Ă$_{28}$	KOZAL	0.792109	46
Ă$_{29}$	KRDMD	0.905363	30
Ă$_{30}$	MGROS	0.965707	11
Ă$_{31}$	ODAS	0.895092	33
Ă$_{32}$	OTKAR	0.858115	38
Ă$_{33}$	OYAKC	0.846160	39
Ă$_{34}$	PETKM	0.930501	21
Ă$_{35}$	PGSUS	0.845413	40
Ă$_{36}$	SASA	0.970854	9
Ă$_{37}$	SAYAS	0.936964	20
Ă$_{38}$	SISE	0.926524	22
Ă$_{39}$	SOKM	0.975280	6
Ă$_{40}$	TCELL	0.926093	23
Ă$_{41}$	THYAO	0.937109	19
Ă$_{42}$	TOASO	0.903715	31
Ă$_{43}$	TTKOM	0.995678	1
Ă$_{44}$	TTRAK	0.815780	42
Ă$_{45}$	TUKAS	0.921587	24
Ă$_{46}$	TUPRS	0.964924	12
Ă$_{47}$	ULKER	0.911346	26
Ă$_{48}$	VESBE	0.977404	5
Ă$_{49}$	VESTL	0.879879	36
Ă$_{50}$	ZOREN	0.949470	18

4 FINDINGS

In the results of the FCF-SIWEC-RBNAR hybrid method application, three key findings were identified. The first finding is the impact levels of the experts in the decision-making process. The second finding is the importance levels of the criteria in the decision-making process. The third finding is the financial performance rankings of the selected companies for the years 2020, 2021, 2022, and 2023. The findings obtained are as follows:

First finding: In the research, the impact levels of the experts involved in determining the financial performance of the companies are as follows: " $\exists_3 = \exists_6 = \exists_7 > \exists_1 = \exists_2 = \exists_4 > \exists_5 = \exists_8$." In this case, the third, sixth, and seventh experts were identified as the most influential experts in the decision-making process.

Second finding: The importance ranking of the financial ratio criteria used in the financial performance calculation is as follows: " $Debt - to - Equity\ Ratio\ (\wp_4 = 0.1464) >$ $Leverage\ Ratio(\wp_3 = 0.1453) >$ $Net\ Profit\ Margin\ (\wp_7 = 0.1438) >$ $Operating\ Profit\ Margin\ (\wp_5 = 0.1429) >$ $Pre - tax\ Profit\ Margin(\wp_6 = 0.1428) >$ $Equity\ Profitability\ Ratio\ (\wp_1 = 0.1426) >$ $Return\ on\ Assets\ (ROA)\ Ratio(\wp_2 = 0.1362) >$." According to this ranking, the fourth criterion, which has very similar importance levels to the others, is determined to play the most significant role in the decision-making process.

Third finding: The top three companies with the highest financial performance for the year 2020 are ranked as "KONTR, ULKER, AKSA." For the year 2021, the top three companies with the highest financial performance are ranked as "TUKAS, ENJSA, VESBE." For the year 2022, the top three companies with the highest financial performance are ranked as "CCOLA, BIMAS, BRSAN." Finally, for the year 2023, the top three companies with the highest financial performance are ranked as "“TTKOM, BIMAS, BRSAN”.

5 CONCLUSIONS

This study aimed to develop a novel hybrid method for financial performance analysis, designed as a decision support system, and referred to as the FCF-SIWEC-RBNAR method. The proposed method integrates FCF sets to calculate expert weights, the FCF-SIWEC approach to determine criteria weights, and the RBNAR technique to evaluate and rank companies based on their financial performance. The methodology was systematically outlined and applied to 50 companies listed on Borsa Istanbul across four different case studies. The findings demonstrate that the FCF-SIWEC-RBNAR hybrid method effectively assessed and ranked companies' financial performance, identifying the Debt-to-Equity Ratio as the most significant financial criterion. Moreover, the financial performance of the companies was calculated for each year, and the top-performing companies were determined. This research contributes

to the literature by introducing a new hybrid approach for financial performance evaluation and demonstrating its practical applicability. The proposed method holds potential for application in both academic research and the financial industry, offering a reliable tool for decision-making in financial performance analysis.

The FCF-SIWEC-RBNAR hybrid method has limitations that warrant consideration. The study's findings are based on data from 50 companies listed on Borsa Istanbul, which may limit generalizability to other markets or industries. The accuracy of the method depends on the quality of financial data and the subjective nature of expert evaluations, which may introduce bias. Additionally, the selected financial ratios may not be universally applicable across all sectors. Further research with broader datasets and diverse economic contexts is needed to validate and enhance the scalability of the method.

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