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EXAMINATION OF FINANCIAL PERFORMANCE OF MANUFACTURING SECTOR COMPANIES IN THE BIST PARTICIPATION SUSTAINABILITY INDEX BY MEREC AND COBRA METHODS

BIST Katılım Sürdürülebilirlik Endeksinde Yer Alan İmalat Sektörü Şirketlerinin Finansal Performansının MEREC ve COBRA Yöntemleriyle İncelenmesi

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Abstract

Measuring corporate financial performance is crucial for maintaining competitive advantage, achieving profitability targets, and ensuring business continuity. The primary aim of this study is to evaluate the financial performance of manufacturing companies listed in the Borsa İstanbul (BIST) Participation Sustainability Index (XSRDK) between 2018 and 2023 by employing the multi-criteria decision-making (MCDM) methods MEREC and COBRA. The dataset consists of 13 manufacturing firms included in the index and eight financial ratios used as evaluation criteria. In the analysis, the MEREC method was applied to determine the weights of the criteria, while the COBRA method was used to rank the firms. A sensitivity analysis was conducted to assess the robustness of the results. Comparisons with alternative MCDM methods and weighting approaches revealed strong correlations across the yearly rankings, supporting the consistency and reliability of the proposed MEREC-COBRA approach in financial performance evaluation.

Keywords: Participation Sustainability Index, Financial Performance, Manufacturing Sector, MEREC, COBRA, Multi-Criteria Decision Making

JEL Codes: G10, G30, Q56

Öz

Şirketlerin finansal performanslarının ölçülmesi, rekabette üstünlüğün sağlanması, karlılık hedeflerine ulaşılması ve faaliyetlerin sürekliliği açısından önemlidir. Bu çalışmanın temel amacı, Borsa İstanbul (BIST) Katılım Sürdürülebilirlik Endeksi'nde (XSRDK) yer alan imalat sektörü şirketlerinin 2018-2023 yılları arasındaki finansal performanslarının çok kriterli karar verme yöntemlerinden MEREC ve COBRA yöntemleri ile incelenmesidir. Çalışmanın veri seti, BIST Katılım Sürdürülebilirlik Endeksi'nde yer alan ve imalat sektöründe faaliyet gösteren 13 şirket ile çalışmada kriter olarak kullanılan sekiz (8) adet finansal orandan oluşmaktadır. Analizlerde MEREC yöntemi ile kriterlerin önem ağırlıkları tespit edilirken, COBRA yöntemi ile firmalar arasındaki performans sıralaması belirlenmiştir. Analiz sonuçlarının güvenilirliğini test etmek amacıyla duyarlılık analizi gerçekleştirilmiştir. Farklı çok kriterli karar verme (ÇKKV) yöntemleri ve kriter ağırlıklandırma yaklaşımlarıyla yapılan karşılaştırmalar, yıllar itibarıyla elde edilen sıralamaların birbirleriyle güçlü bir korelasyona sahip olduğunu göstermiştir. Bu bulgu, çalışmada önerilen MEREC-COBRA yaklaşımının diğer yöntemlerle tutarlı ve güvenilir sonuçlar verdiğini desteklemektedir.

Anahtar Kelimeler: Katılım Sürdürülebilirlik Endeksi, Finansal Performans, İmalat Sektörü, MEREC, COBRA, Çok Kriterli Karar Verme

JEL Kodları: G10, G30, Q56

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1. Introduction

Sustainability is defined as a method of managing financial risks, environmental risks, and social risks, duties, and opportunities of companies (Brescia et al., 2021: 45). In other words, sustainability can be defined as economic development based on the use of renewable or replaceable resources, taking into account the environmental consequences of the activities related to the economy (Gedik, 2020: 205). The concept of sustainability can be considered one of the priority business areas that takes into account the work of companies in economic, social, and environmental dimensions. Today, investment forms known as socially responsible investments or morally responsible investments, which correspond to investments in financial instruments that attach importance to a sustainable environment, are called green investments or ethical investments (Ghoul and Karam, 2007: 96). The concepts altruism and social justice are interrelated with green investments that aim to contribute to the proper use of natural resources and environmental sustainability. Similarly, Islamic rules such as the prohibition of interest and waste and issues such as charity and zakat based on Islam can also be evaluated in terms of ethical values, social justice, and environmental sustainability (Güçlü, 2019: 248). Islamic stock indices, which are part of Islamic finance, are known as participation indices in our country. According to this index, firms are evaluated in terms of rules based on Islam, and firms that meet the relevant conditions are included in the index (Göktaş and Güçlü, 2023: 226). In this context, it can be said that green investments, known as morally responsible investments, and participation indices created within the framework of Islamic finance rules are related to each other in terms of giving importance to concepts such as social justice, altruism, ethical values, and a sustainable environment.

The BIST Participation Sustainability Index, which was first published by Borsa Istanbul (BIST) in 2021, includes companies that meet both the BIST Sustainability and BIST Participation index conditions (BIST, 2024). The BIST Participation Sustainability Index is a service offered within the framework of Islamic finance for investors who want to invest in shares that overlap with sustainability principles, and at the same time, are related to participation principles (Kılıçarslan, 2022: 1). The BIST Participation Sustainability Index is an indicator of the existence of a relationship between sustainability and Islamic finance. Therefore, the stocks of the companies included in the relevant index are considered to be a suitable option, especially for investors who aim to invest within the framework of social responsibility or Islamic rules. However, considering the development of the index and the criteria for inclusion, it should not be overlooked that it is not exclusively an investment instrument for investors with Islamic sensitivity. Strong financial performance is one of the factors affecting rational investment decisions. Financial performance is an indicator that provides information to investors about the future performance of enterprises. At the same time, it enables to determination of how effectively the existing resources of the enterprises and the assets obtained from them are used (Arman et al., 2022: 803). Financial performance is the competitiveness and risk-taking ability of an enterprise for investment and profitability targets (Karatepe, 2008: 89). Financial performance evaluation is a measurement that plays an important role in the development and change of enterprises in different sectors.

The aim of this study is to measure the financial performance of the manufacturing sector companies registered in the BIST Participation Sustainability Index between 2018 and 2023 with integrated MCDM approaches. The place of the manufacturing sector in a country's economy is the most fundamental indicator of that country's development process (Polat, 2011: 25). If developing countries have a sufficiently strong manufacturing industry, they grow faster than other countries and increase their welfare level rapidly. In addition, technological advances in the manufacturing sector spread to other sectors over time and increase the productivity of these sectors (Strategy and Budget Presidency, 2018). In the study, MEREC (Method Based on the Removal Effects of Criteria), one of the objective weighting methods, and COBRA (Comprehensive Distance Based Ranking), a new approach to ranking alternatives, were analyzed in an integrated manner. In addition, the validity and robustness of the model used in the study were tested by applying sensitivity analysis consisting of two stages.

The most important contribution of this study to the literature is that it employs the integrated model together for the first time in the relevant field. In addition, the study interval of 2018-2023, which covers the pre-pandemic and post-pandemic periods, provides the opportunity to compare the financial performance of companies across these periods, which is one of the study's unique aspects. The manufacturing sector is a sector that includes many interrelated sub-sectors. The impact of the manufacturing sector on others, being a strong building block and crucial for the development of the country's economy, underscores the importance of the study. In addition, the limited number of studies in the literature within the scope of the BIST Participation Sustainability Index and the introduction of new methods to the literature emphasize the importance of the study. The literature section of the study, which consists of six chapters, summarizes the studies on its subject and its methods. In the data set and method section, the data used in the study, the methods applied, and the application steps of these methods are presented in detail. In the findings section, the results obtained from the analyses are presented. In the sensitivity analysis section, the validity and robustness of the proposed model are evaluated by comparing the results obtained from different methods. In the discussion and conclusion section, the results are compared with the results found in similar studies in the literature, and suggestions are made for future studies.

2. Literature Review

Performance measurement in companies enables the assessment of corporate sustainability and success. Financial performance refers to the evaluation of companies achieving economic targets and the profitability and efficiency of company activities (Cebeci and Özbilgin, 2015: 50). It has been observed that multi-criteria decision-making methods are frequently used in studies on financial performance evaluations of manufacturing sector companies. Some of the studies in which MCDM methods are used in the financial performance measurement of companies in manufacturing sectors and sub-sectors traded in BIST are summarized in chronological order. In their study, Aytekin and Sakarya (2013) evaluated the financial performance of 20 food enterprises registered in BIST for the years 2009-2012, using 10 financial ratios with the TOPSIS method. As a result of the analysis, it was concluded that no company consistently performed best over the entire period, due to the 2008 global financial crisis, but there were companies with good performance on a yearly basis. These companies were identified as KRSTL, PNSUT, BANVT, PETUN, and CCOLA. Bakırcı et al. (2014) evaluated the financial performance of 14 companies from the BIST Iron, Steel, Metal Main Industry sector for the period 2009-2011 with DEA Super Efficiency and TOPSIS methods. The Super Efficiency method was used to select the most efficient company among the companies determined as efficient by the DEA method. As a result, EREĞLİ Enterprise was found to be the most efficient company. According to the TOPSIS method, EREĞLİ company was determined to have the most efficient performance. Akbulut and Rençber (2015) analyzed the financial performance of 32 companies registered in the BIST Manufacturing sector for the years 2010-2012, using the TOPSIS method. In addition to financial performance, the stock market performance of the companies was evaluated in the study. As a result of the analysis, Adana Cement Company was determined as the company with the best financial performance both on a yearly basis and in the overall score. Meydan et al. (2016) used the Grey Relational Analysis (GRA) method in another study on financial performance measurement for BIST Food enterprises. In the study, the financial statement data of 10 companies for the period of 2012 and their financial ratios were analyzed. As a result of the analysis, Ülker Gıda, which exhibited strong performance in terms of profitability ratios, ranked first. Akyüz et al. (2018) evaluated the financial performance of 14 enterprises in the Paper and Paper Products Printing and Publishing sector traded in BIST for the years 2012-2017 by using TOPSIS, PROMETHEE, and COPRAS methods. The analyses showed that similar results were obtained with the TOPSIS and the PROMETHEE methods, while the COPRAS method gave different results in some years compared to the other two methods. It is suggested that this situation is related to the borrowing ratios, which are treated as negative during the application of the COPRAS method, and show excessive deviations in the relevant years. In his study, Işıldak (2018) evaluated the financial performances of 20 enterprises from the BIST Weaving, Clothing, and Leather Enterprises between 2014-2017, utilizing the TOPSIS method using 11 financial ratios. According to the results obtained, DESA company showed the best performance between 2014 and 2016, and BRMEN company showed in 2017. Şahin and Sarı (2019) used Entropy in criteria weighting and TOPSIS and VIKOR methods in ranking alternatives in order to measure the financial performance of 27 manufacturing sector companies registered in BIST for the years 2013-2016 was analyzed. They also investigated the relationship between the financial performance of the companies and their stock market performance. It was emphasized that the use of the Entropy method in criteria weighing and the comparison of financial performance and stock market performance added a unique contribution to the study.

Küçükönder and Şişmanoğlu (2020) analyzed the financial performance of 21 enterprises in the BIST textile and leather sector. Criteria weights were determined by the entropy method, and a hybrid method including the EATWIOS, MAUT, and WASPAS methods was used to evaluate the performance. The study concluded that Entropy-based WASPAS is the most appropriate method for performance analysis and performance ranking of companies in the textile sector. Secondly, the conclusion was that the Entropy-based EATWIOS and the Entropy-based MAUT method gave feasible results. Acar and Sarıyer (2021) analyzed the financial performance of 17 basic metal industry companies registered in BIST by using financial ratios determined for 2017. The AHP method was used for criterion weighting, and the TOPSIS method was used for ranking the companies according to these weights. The companies were ranked and compared according to their closing prices for 2017, and it was observed that both rankings for 15 companies gave similar results. According to the results of this analysis, the conclusion was that it is appropriate to combine AHP and TOPSIS and use them in financial performance evaluation. Yıldırım et al. (2021) analyzed the financial performance of four iron and steel manufacturing companies listed in the BIST Main Metal Index (XMANA) for the 2011–2019 period using the GRA method. Based on seven financial ratios, the company with the highest performance was identified as EREGL in 2011 and 2013, KRDM in 2012, and ISDMR throughout the 2014–2019 period. In his study, Çanakçıoğlu (2022) proposed a new model consisting of MCDM methods for measuring the financial performance of companies traded in the BIST Textile Index. A model consisting of CRITIC and MAIRCIA methods was proposed based on the criteria set determined in the study. In addition, to ensure the consistency and validity of the model, a comprehensive sensitivity analysis was performed across 99 different scenarios. As a result of the analyses, the suitability of the model was determined. In their study, Kendirli and Yıldırım (2022) evaluated the financial performance of 11 automotive manufacturing companies traded on BIST between 2015 and 2019 using the TOPSIS method. The authors emphasized that the automotive sector is linked to other sectors and acts as a locomotive for the national economy. For this reason, they foresee that financial performance analyses in this sector will contribute to its development and guide the investments to be made. Asker (2022) analyzed the financial performance of 50 manufacturing firms listed on BIST for the 2019–2020 period by applying the CRITIC-based CoCoSo method in the context of the pre-pandemic and pandemic periods of COVID-19. The findings of the study revealed that the food, beverage, and tobacco sector was the most adversely affected by the pandemic, whereas the chemicals, pharmaceuticals, rubber, petroleum, and plastics sector was the least affected. Bardi (2023) examined the financial performance of nine manufacturing sub-sectors operating on BIST for the 2017–2022 period using the GRA method. The study employed 22 financial ratios, and the findings indicated that operating expenses were the most influential factor affecting the financial performance of the sectors. In particular, the reduction of cost of goods sold and financial expenses was found to have a positive impact on performance. Ersoy (2023) analyzed the 2021 financial performance of 39 companies operating in the BIST Chemicals, Petroleum, Rubber, and Plastic Products sector using the SECA method and tested the reliability of the results through sensitivity analysis. In the final ranking obtained via the Copeland method, ANGEN, ALKIM, and ACSEL were identified as the companies with the highest performance. Bozdoğan et al. (2023) examined the financial performance of companies in the cement sector listed on Borsa Istanbul for the 2013–2022 period. In the study, financial ratios frequently cited in the literature were selected as evaluation criteria and weighted using the CRITIC method. For performance measurement, the TOPSIS and ELECTRE methods were applied, whereby companies were both ranked and classified into three performance groups: high, medium, and low. According to the results of the analysis, OYAK, NUHCM, and KONYA were identified as the top-performing companies, while BTCIM was determined to be the company with the lowest performance. Güçlü and Göktaş (2023) evaluated the financial performance of 11 manufacturing sector companies registered in the BIST Participation Sustainability Index for the year 2022, by using Entropy-weighted TOPSIS and PES methods. According to the results of both methods, AKSA was determined as the company with the best performance. With this study, the authors have helped relevant company managers understand their companies' positions among similar companies and develop appropriate policies accordingly. In addition, they have presented a study that can help investors who are considering investing in this sector at the decision-making stage.

Pala et al. (2024) evaluated the financial performance of 16 companies in the BIST Cement Index for the 2020–2022 period using the LODECI and CRADIS methods. The findings revealed the critical importance of return on equity and further demonstrated that companies with low financial performance need to enhance both their return on equity and net profit margins. Arslan (2024) evaluated the financial performance of companies in the textile and apparel sector listed on Borsa Istanbul for the 2020–2022 period using the COPRAS method. According to the analysis, BLCYT was identified as the top-performing firm in 2020 and 2022, while ARSAN was identified as the top-performing firm in 2021. The lowest-performing companies were KRTEK in 2020, YUNSA in 2021, and ATEKS in 2022. Göktaş (2024), in his two-stage analysis based on the sustainability scores of technology companies in the BIST Participation Sustainability Index, obtained performance scores with the Robust Theoretical Fuzzy Evaluation System (R-FES), one of the fuzzy MCDM approaches, was used made a sustainable portfolio recommendation based on these scores. Ok and Göktaş (2024) also measured the sustainability performance of service sector firms in the BIST Participation Sustainability Index, with R-FES. Özarı and Çanakçıoğlu (2025) analyzed the 2023 financial performance of eight automobile manufacturing firms listed on Borsa Istanbul. The weights of the financial criteria were determined using the CRITIC method, while performance rankings were conducted using the TOPSIS and VIKOR methods. The analysis revealed that the most influential criterion was the ratio of short-term liabilities to total debt. According to the rankings, TTRAK was identified as the top-performing firm under the TOPSIS method, whereas FROTO and TOASA were identified as the top-performing firms under the VIKOR method. Kavas (2025) examined the financial performance of six companies operating in the Basic Metal Industry sector listed on Borsa Istanbul for the 2018–2023 period. The weights of the financial ratios were determined using the ENTROPY method, while performance analyses were conducted using the PROMETHEE II and WASPAS methods. According to the results, Ereğli and İskenderun Demir Çelik were identified as the top-performing firms in the PROMETHEE II rankings, whereas İzmir Demir Çelik, despite demonstrating low performance between 2018 and 2021, rose to higher positions in the last two years. Süzülmüş (2025) analyzed the financial performance of 26 firms operating in the textile, apparel, and leather sectors listed on Borsa Istanbul for the 2020–2023 period. The financial ratios used in the study were weighted using the CRITIC method, while performance rankings were obtained through the COPRAS and MABAC methods. The findings revealed a persistent pattern in performance rankings over the years, with certain companies consistently occupying the top three and bottom three positions.

In recent years, Multi-Criteria Decision-Making (MCDM) methods have been widely employed to evaluate the financial performance of companies listed on Borsa İstanbul. Among these, GRA, TOPSIS, VIKOR, and COPRAS have emerged as commonly applied approaches for analytically assessing corporate financial performance (Yıldırım et al., 2021; Arslan, 2024; Kavas, 2025; Özarı and Çanakçıoğlu, 2025). Although these conventional methods provide valuable insights into financial performance, they exhibit certain limitations in the objective determination of criterion weights and the establishment of reliable performance rankings.

Although the MEREC and COBRA methods are relatively new methods, the number of studies in which they are used in an integrated manner has tended to increase recently. Popović et al. (2022) used MEREC and COBRA methods in the selection process of a strategy for the development of e-commerce, Vatansever (2024) used these methods in proposing an alternative model to university ranking approaches, Oğuz and Satır (2024) used them in measuring the financial performance of BIST retail trade companies, Asker (2024) used them in measuring the financial performance of airline companies, Çıtak and Ünlü (2024) used MEREC and COBRA methods in the performance measurement of banks traded in BIST based on sustainability reports, and Ergün and Bulut (2024) used MEREC and COBRA methods in the measurement of the financial and operating performance of an iron and steel enterprise. In this study, the MEREC and COBRA methods were employed to overcome these limitations and enhance the reliability of the analyses. The MEREC method systematically evaluates the impact of omitting each criterion on the overall decision, thereby enabling the objective determination of criterion weights and minimizing biases arising from subjective assessments. The COBRA method, on the other hand, provides a compromise ranking mechanism that accounts for both linear and non-linear interactions among criteria, thereby improving the sensitivity and reliability of the performance rankings. The integrated application of the MEREC and COBRA methods not only overcomes the limitations of traditional MCDM approaches but also enhances the analytical rigor of financial performance analyses, providing decision-makers with more reliable, consistent, and meaningful results. The most important contributions of the study to the literature are: there are very few studies about companies within the BIST Participation Sustainability Index; the proposed integrated model is used for the first time in the relevant sector; and the analysis covers the period between 2018-2023, allowing the comparison of the financial performance of the companies in this index before and after the COVID-19 pandemic.

3. Data Set and Methodology

3.1. Data Set

In the study, the financial statement data of the companies registered in the BIST Participation Sustainability Index for the years 2018-2023 were used. Data on companies were obtained from the Borsa Istanbul Public Disclosure Platform (PDP, 2024). As of September 2024, 31 companies were included in the BIST Participation Sustainability Index, of which 13 out of 15 operating in the manufacturing sector were part of the study. QUA Granite Hayal Yapı ve Ürünleri Sanayi Ticaret A.Ş. and SUN Tekstil Sanayi ve Ticaret A.Ş., which are among the manufacturing sector companies, were not included in the study since their financial data for the years 2018-2023 were not available. Table 1 lists the manufacturing sector companies included in the BIST Participation Sustainability Index in alphabetical order.

Table 1. Manufacturing Sector Companies in the BIST Participation Sustainability Index

BIST Code	Company Name
AKCNS	Akçansa Çimento Sanayi ve Ticaret A.Ş.
AKSA	Aksa Akrilik Kimya Sanayii A.Ş.
CCOLA	Coca-Cola İçecek A.Ş.
CIMSA	Çimsa Çimento Sanayi ve Ticaret A.Ş.
EREGL	Ereğli Demir ve Çelik Fabrikaları T.A.Ş.
ISDMR	İskenderun Demir ve Çelik A.Ş.
KRDMD	Kardemir Karabük Demir Çelik Sanayi ve Ticaret A.Ş.
OTKAR	Otokar Otomotiv ve Savunma Sanayi A.Ş.
PETKM	Petkim Petrokimya Holding A.Ş.
SASA	Sasa Polyester Sanayi A.Ş.
TUPRS	Tüpraş-Türkiye Petrol Rafinerileri A.Ş.
VESBE	Vestel Beyaz Eşya Sanayi ve Ticaret A.Ş.
VESTL	Vestel Elektronik Sanayi ve Ticaret A.Ş.

Financial ratios used in financial analyses are the ratios that allow for the examination of a company’s balance sheet horizontally and vertically and to establish relationships between items (Sarıkamış, 2007: 44). Within the scope of the study, the financial ratios used in the evaluation of the financial performance of the companies were determined as eight under four main headings. Current ratio and acid test ratio were used to measure liquidity, financial leverage ratio and financing ratio were used to measure financial structure ratios, asset turnover ratio and inventory turnover ratio were used to measure activity ratios, and net profit margin and return on assets ratio were used to measure profitability. In the selection of the financial ratios in the study, those frequently used in the literature were preferred by examining studies on the manufacturing sector, particularly those evaluating the financial performance of companies registered in BIST. Table 2 shows the financial ratios used in the study.

Table 2. Financial Ratios Used in the Study

Rate Group	Ratio	Direction	Source
Liquidity Ratios	Current Ratio	Benefit	Akbulut and Rençber, 2015; Akyüz and Yeşil, 2017; Arslan, 2024; Çolak, 2023; Aytekin and Sakarya, 2013; Güçlü and Göktaş, 2023; Güleç and Özkan, 2018; Kayalı and Aktaş, 2018; Kılıçarslan, 2022; Meydan et al., 2016; Pala, 2023.
	Acid Test Rate	Benefit	Akbulut and Rençber, 2015; Akyüz and Yeşil, 2017; Arslan, 2024; Güçlü and Göktaş, 2023; Güleç and Özkan, 2018; Kılıçarslan, 2022; Meydan et al., 2016.
Financial Structure Ratios	Financial Leverage Ratio	Cost	Akyüz and Yeşil, 2017; Arslan, 2024; Aytekin and Sakarya, 2013; Güçlü and Göktaş, 2023; Güleç and Özkan, 2018; Kılıçarslan, 2022.
	Financing Rate	Benefit	Akyüz and Yeşil, 2017; Aytekin and Sakarya, 2013; Güleç and Özkan, 2018.
Activity Ratios	Asset Turnover Rate	Benefit	Akbulut and Rençber, 2015; Akyüz and Yeşil, 2017; Güçlü and Göktaş, 2023; Güleç and Özkan, 2018; Kılıçarslan, 2022; Meydan et al., 2016; Pala, 2023.
	Inventory Turnover Rate	Benefit	Akbulut and Rençber, 2015; Akyüz and Yeşil, 2017; Arslan, 2024; Güçlü and Göktaş, 2023; Kayalı and Aktaş, 2018; Kılıçarslan, 2022; Meydan et al., 2016.
Profitability Ratios	Return on Assets Ratio	Benefit	Akbulut and Rençber, 2015; Akyüz and Yeşil, 2017; Arslan, 2024; Çolak, 2023; Güçlü and Göktaş, 2023; Kılıçarslan, 2022; Meydan et al., 2016; Pala, 2023.
	Net Profit Margin	Benefit	Akbulut and Rençber, 2015; Güçlü and Göktaş, 2023; Kılıçarslan, 2022; Meydan et al., 2016; Pala, 2023.

In the data set of the study, 13 manufacturing companies were used as alternatives, and 8 financial ratios as criteria. Table 3 lists the alternatives and criteria sets used in this study.

Table 3.Alternatives and Criteria Used in the Study

Code	Alternatives	Code	Criteria
A1	AKCNS	**C1**	Current Ratio
A2	AKSA	**C2**	Acid Test Rate
A3	CCOLA	**C3**	Financial Leverage Ratio
A4	CIMSA	**C4**	Financing Rate
A5	EREGL	**C5**	Asset Turnover Rate
A6	ISDMR	**C6**	Inventory Turnover Rate
A7	KRDMD	**C7**	Return on Assets Ratio
A8	OTKAR	**C8**	Net Profit Margin
A9	PETKM		
A10	SASA		
A11	TUPRS		
A12	VESBE		
A13	VESTL		

3.2. Methodology

In this study, while the importance weights of the criteria were determined by the MEREC method, the performance ranking of the firms was determined by the COBRA method. The process steps related to these methods are given in detail below.

3.2.1. MEREC Method

The MEREC was introduced to the literature by Keshavarz-Ghorabaee et al. (2021: 7-9) as one of the MCDM methods. With this method, the impact of removing each criterion on the performance of the alternatives is used to determine the criteria weights. Criteria with a greater impact on performance are given higher weights. The following steps are used when calculating objective weights according to the MEREC method (Keshavarz-Ghorabaee et al., 2021: 7-9):

Step 1. Creating the Decision Matrix:

A decision matrix showing the rating of each alternative is created where n represents alternatives and m represents criteria. This matrix consists of x_{ij} elements greater than zero. Here are $\forall i$ = 1,…, n and $\forall j$ = 1,…, m. If there are elements with negative values in the decision matrix, they should be converted to positive values by appropriate operations. The form of the decision matrix is as follows:

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1j} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2j} & \cdots & x_{2m} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{i1} & x_{i2} & \cdots & x_{ij} & \cdots & x_{im} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nj} & \cdots & x_{nm} \end{bmatrix} \tag{1}$$

Step 2. Determination of the Normalized Decision Matrix:

In this step, the decision matrix is normalized using Equation (2) below. The elements of the normalized matrix are denoted by n_{ij}^{x}. B where C is the set of benefit criteria and is the set of cost criteria;

$$n_{ij}^{x} = \begin{cases} \dfrac{\underset{k}{min} x_{kj}}{x_{ij}} & if\ j\epsilon B \\ \dfrac{x_{ij}}{\underset{k}{max} x_{kj}} & if\ j\epsilon C \end{cases} \tag{2}$$

Step 3. Finding the Total Performance Value (S_i):

The total performance value of the alternatives (S_i) is calculated with the help of Equation (3) below.

$$S_i = In\left(1 + \left(\frac{1}{m}\sum_{j}\left|In\left(n_{ij}^{x}\right)\right|\right)\right) \tag{3}$$

Step 4. Finding the Performance of Alternatives (S'_{ij}):

Each criterion is extracted separately, and the performance of the alternatives is determined using Equation (4). S'_{ij} represents the overall performance of the alternative i excluding the criterion j.

$$S'_{ij} = In\left(1 + \left(\frac{1}{m}\sum_{k,k\neq j}|In(n_{ik}^{x})|\right)\right) \tag{4}$$

Step 5. Calculation of the Sum of Absolute Deviations (E_j):

In this step, the lifting effect (E_j) of criterion j is calculated by substituting the values calculated using Equations (3) and (4) in Equation (5).

$$E_j = \sum_i |S'_{ij} - S_i| \tag{5}$$

Step 6. Calculation of Importance Weights of Criteria (w_j):

In this last step, the objective weight of each criterion is calculated with the help of the lifting effects (E_j) obtained in Equation (5). Here, w_j, denotes the weight of the j. criterion.

$$w_j = \frac{E_j}{\sum_k E_k} \tag{6}$$

3.2.2. COBRA Method

The COBRA method is a new method introduced to the literature by Krstić et al. (2022). It is a distance-based MCDM method that differs from other distance-based methods by offering positive and negative ideal solution points derived from averages, and by using both Euclidean and taxicab distance measurement methods together. This method is used in the evaluation and ranking of alternatives. The steps of the method are listed as follows:

Step 1. Creating the Decision Matrix:

As explained in the MEREC method section, i = (1, 2,…,) alternatives, j = (1, 2,…, m) criteria, A decision matrix is created.

$$A = \left[\begin{pmatrix} a_{11} & \cdots & a_{1m} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nm} \end{pmatrix}\right]$$

Step 2. Creating the Normalized Decision Matrix:

The normalized decision matrix Δ in Equation (7) is constructed.

$$\Delta = [\alpha_{ij}]_{n\times m} \tag{7}$$

$$\alpha_{ij} = \frac{a_{ij}}{\max_i a_{ij}} \tag{8}$$

Step 3. Constructing the Weighted Normalized Decision Matrix:

Equation (9) is used to create a normalized decision matrix weighted by Δ_w . Here, w_j, j is the relative weight of the criterion.

$$\Delta_w = [w_j \times \alpha_{ij}]_{n\times m} \tag{9}$$

Step 4. Determination of Positive Ideal, Negative Ideal and Average Solution for the Criteria:

For each criterion, the positive ideal (PIS_j), negative ideal (NIS_j), and average solution (AS_j), are determined as in Equations (10), (11) and (12) respectively. Here, J^B is the set of benefit criteria and J^C is the set of cost criteria.

$$\begin{aligned} PIS_j &= \max_i\left(w_j \times \alpha_{ij}\right), \ \forall j = 1, \dots, m.\ j \in J^B \\ PIS_j &= \min_i\left(w_j \times \alpha_{ij}\right), \ \forall j = 1, \dots, m.\ j \in J^C \end{aligned} \tag{10}$$

$$\begin{aligned} NIS_j &= \min_i\left(w_j \times \alpha_{ij}\right), \ \forall j = 1, \dots, m.\ j \in J^B \\ NIS_j &= \max_i\left(w_j \times \alpha_{ij}\right), \ \forall j = 1, \dots, m.\ j \in J^C \end{aligned} \tag{11}$$

$$AS_j = \frac{\sum_{i=1}^{n}\left(w_j \times \alpha_{ij}\right)}{n}, \forall j = 1, \dots, m.\ j \in J^B, J^C \tag{12}$$

Step 5. In this step, the distances from the positive ideal ($d(PIS_j)$) and negative ideal ($d(NIS_j)$) solutions are found for each alternative. In addition, the positive ($d(AS_j^+)$) and negative ($d(AS_j^-)$) distances from the average solution are determined as follows.

$$d(S_j) = dE(S_j) + \sigma \times dE(S_j) \times dT(S_j), \forall j = 1, \dots, m \tag{13}$$

where σ is the correction coefficient in Equation (14) for any S_j solution (PIS_j, NIS_j, AS_j).

$$\sigma = \max_i dE(S_j)_i - \min_i dE(S_j)_i \tag{14}$$

$dE(S_j)_i$ and $dT(S_j)_i$ to denote Euclidean and Taxicab distances respectively;

The calculated positive ideal solution is as in Equations (15) and (16). Here is $\forall i = 1, \dots, n$ and $\forall j = 1, \dots, m$.

$$dE(PIS_j)_i = \sqrt{\sum_{j=1}^{m}\left(PIS_j - w_j \times \alpha_{ij}\right)^2} \tag{15}$$

$$\mathrm{dT(PIS_j)_i} = \sum_{\mathrm{j=1}}^{\mathrm{m}}\left|\mathrm{PIS_j} - \mathrm{w_j} \times \alpha_{\mathrm{ij}}\right| \tag{16}$$

The negative ideal solution obtained is as in Equation (17) and Equation (18). Here is $\forall i = 1, \dots, n$ and $\forall j = 1, \dots, m$.

$$dE(NIS_j)_i = \sqrt{\sum_{j=1}^{m}(NIS_j - w_j \times \alpha_{ij})^2} \tag{17}$$

$$dT(NIS_j)_i = \sum_{j=1}^{m}\left|NIS_j - w_j \times \alpha_{ij}\right| \tag{18}$$

Equations obtained for positive distance from the average solution are as follows. Here is $\forall i = 1, \ldots, n$ and $\forall j = 1, \ldots, m$.

$$dE(AS_j)_i^+ = \sqrt{\sum_{j=1}^{m}\tau^+(AS_j - w_j \times \alpha_{ij})^2} \tag{19}$$

$$dT(AS_j)_i^+ = \sum_{j=1}^{m}\tau^+\left|AS_j - w_j \times \alpha_{ij}\right| \tag{20}$$

$$\tau^+ = \begin{cases} 1, & AS_j < w_j \times \alpha_{ij} \\ 0, & AS_j > w_j \times \alpha_{ij} \end{cases} \tag{21}$$

The Equations determined for the negative distance from the mean solution are as follows. Here is $\forall i = 1, \ldots, n$ and $\forall j = 1, \ldots, m$.

$$dE(AS_j)_i^- = \sqrt{\sum_{j=1}^{m}\tau^-(AS_j - w_j \times \alpha_{ij})^2} \tag{22}$$

$$dT(AS_j)_i^- = \sum_{j=1}^{m}\tau^-\left|AS_j - w_j \times \alpha_{ij}\right| \tag{23}$$

$$\tau^- = \begin{cases} 1, & AS_j > w_j \times \alpha_{ij} \\ 0, & AS_j < w_j \times \alpha_{ij} \end{cases} \tag{24}$$

Step 6. Finally, in this step, Equation (25) is used to rank the alternatives according to the comprehensive distances. Here it is $\forall i = 1, \ldots, n$.

$$dC_i = \frac{d(PIS_j)_i - d(NIS_j)_i - d(AS_j)_i^+ + d(AS_j)_i^-}{4} \tag{25}$$

4. Findings

In the study, the financial performances from 2018 to 2023 of 13 manufacturing sector companies, traded in the BIST Participation Sustainability Index as of September 2024, were analyzed by MEREC and COBRA methods. Before the analysis phase, a decision matrix containing the data and alternatives related to the financial ratios used to evaluate the companies was created. The decision matrix obtained with the financial statement data of the companies for the years 2018-2023 is shown in Table 4. For the integrity of the study, only the analyses for 2023 are included, and the results for other years are presented in the last part of the study.

Table 4. Decision Matrix for 2018-2023

				2018				
Alternatives	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
A1	1.152	0.868	48.736	1.052	0.842	6.820	0.088	10.478
A2	1.190	0.954	65.443	0.528	0.938	6.450	0.059	6.340
A3	1.700	1.399	53.990	0.852	0.775	10.377	0.026	3.390
A4	0.654	0.522	58.339	0.714	0.505	7.679	0.046	9.051
A5	2.854	1.727	29.983	2.335	0.770	2.675	0.167	21.635
A6	3.363	2.062	25.040	2.994	0.912	3.457	0.236	25.871
A7	1.384	0.603	50.356	0.986	0.736	3.227	0.107	14.585
A8	2.076	1.281	83.082	0.204	0.779	1.969	0.076	9.790
A9	2.070	1.778	67.151	0.489	0.914	7.647	0.082	8.978
A10	1.248	0.777	58.199	0.718	0.667	4.122	0.183	27.417
A11	1.314	0.890	75.158	0.331	2.265	13.160	0.096	4.248
A12	1.115	0.904	61.333	0.630	1.476	8.861	0.161	10.934
A13	0.740	0.529	81.525	0.227	0.997	3.986	0.025	2.529
				2019				
Alternatives	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
A1	1.175	0.896	48.199	1.075	0.876	7.383	0.036	4.105
A2	1.052	0.728	63.342	0.579	0.871	5.228	0.066	7.616
A3	1.545	1.299	53.825	0.858	0.817	9.595	0.063	7.695
A4	0.783	0.646	60.639	0.649	0.476	7.584	0.004	0.880
A5	2.554	1.567	33.050	2.026	0.621	2.465	0.079	12.722
A6	3.323	1.956	25.115	2.982	0.772	3.354	0.101	13.100
A7	1.057	0.503	57.004	0.754	0.704	3.261	0.009	1.327
A8	1.872	1.132	76.187	0.313	0.976	2.073	0.141	14.465
A9	1.861	1.680	67.240	0.487	0.852	9.784	0.056	6.547
A10	0.477	0.254	66.662	0.500	0.464	3.732	0.179	38.505
A11	0.993	0.656	76.335	0.310	1.876	10.437	0.012	0.653
A12	1.059	0.843	63.758	0.568	1.441	9.930	0.118	8.153
A13	0.656	0.462	80.568	0.241	0.918	4.529	0.019	2.049
				2020				
Alternatives	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
A1	1.238	1.023	50.365	0.986	0.886	9.051	0.052	5.838
A2	1.460	1.113	62.116	0.610	0.902	4.821	0.097	10.705
A3	1.773	1.532	54.371	0.839	0.820	9.745	0.075	9.132
A4	0.870	0.792	64.149	0.559	0.466	7.782	0.041	8.883
A5	3.022	1.950	29.093	2.437	0.612	2.688	0.067	10.952
A6	4.601	2.970	22.448	3.455	0.677	3.185	0.097	14.319
A7	1.024	0.646	63.925	0.564	0.758	3.576	0.006	0.807
A8	1.495	0.867	76.758	0.303	0.830	1.630	0.176	21.256
A9	1.999	1.837	62.176	0.608	0.698	10.862	0.062	8.828
A10	0.626	0.325	73.250	0.365	0.544	3.783	0.034	6.193
A11	1.082	0.810	80.917	0.236	1.084	7.162	0.042	3.831
A12	1.260	1.046	59.152	0.691	1.424	9.511	0.202	14.149
A13	0.805	0.567	72.578	0.378	0.926	4.504	0.082	8.852

Table 4. Continued

				2021				
Alternatives	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
A1	0.999	0.569	55.966	0.787	0.968	5.144	0.102	10.574
A2	1.020	0.756	69.986	0.429	1.162	5.940	0.162	13.982
A3	1.432	1.098	54.341	0.840	0.845	8.026	0.093	11.039
A4	1.157	0.797	47.171	1.120	0.722	6.548	0.202	28.045
A5	2.798	1.565	33.133	2.018	0.740	2.187	0.174	23.566
A6	3.026	1.406	29.770	2.359	0.868	2.461	0.154	17.722
A7	1.286	0.953	54.336	0.840	0.905	3.980	0.236	26.094
A8	1.388	0.888	75.014	0.333	0.873	2.022	0.202	23.099
A9	2.563	2.101	58.200	0.718	1.139	9.914	0.219	19.211
A10	0.982	0.555	81.244	0.231	0.888	4.175	0.00004	0.005
A11	1.022	0.651	82.613	0.210	1.844	8.616	0.042	2.276
A12	1.182	0.873	65.519	0.526	1.443	7.559	0.135	9.387
A13	0.682	0.371	76.071	0.315	0.926	3.456	0.061	6.626
				2022				
Alternatives	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
A1	1.105	0.862	54.511	0.834	1.539	8.539	0.263	17.088
A2	1.420	0.913	49.722	1.011	1.673	6.998	0.328	19.606
A3	1.631	1.243	61.176	0.635	1.170	7.879	0.101	8.670
A4	1.190	0.964	47.334	1.113	1.019	7.788	0.423	41.507
A5	2.246	1.017	32.152	2.110	0.848	2.797	0.124	14.597
A6	2.322	0.880	30.646	2.263	0.951	3.156	0.103	10.847
A7	1.300	0.671	56.977	0.755	1.131	4.152	0.090	7.936
A8	1.061	0.674	85.140	0.175	0.954	2.477	0.123	12.902
A9	1.103	0.962	65.133	0.535	1.149	11.304	0.154	13.385
A10	0.545	0.212	68.699	0.456	0.832	3.822	0.284	34.094
A11	1.517	1.060	60.220	0.661	3.550	14.013	0.304	8.564
A12	0.923	0.683	75.247	0.329	1.580	7.490	0.072	4.538
A13	0.616	0.344	79.015	0.266	1.102	4.012	0.021	1.898
				2023				
Alternatives	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
A1	1.449	1.159	29.645	2.373	1.353	11.691	0.171	12.664
A2	1.418	0.918	33.066	2.024	1.314	7.071	0.091	6.903
A3	1.163	0.850	59.191	0.689	1.197	6.918	0.251	20.942
A4	1.362	1.039	38.951	1.567	0.820	8.263	0.123	15.014
A5	1.507	0.753	38.223	1.616	0.610	2.399	0.018	2.927
A6	1.525	0.685	36.563	1.735	0.843	3.224	0.044	5.193
A7	1.311	0.673	38.558	1.594	1.192	4.888	0.037	3.076
A8	1.152	0.797	74.440	0.343	1.168	3.705	0.084	7.225
A9	0.760	0.531	46.354	1.157	0.803	11.929	0.099	12.266
A10	0.817	0.494	56.623	0.766	0.454	3.735	0.178	39.278
A11	1.295	1.009	44.672	1.239	2.563	14.329	0.201	7.847
A12	1.051	0.764	57.596	0.736	1.598	8.767	0.124	7.736
A13	0.616	0.315	67.359	0.485	1.193	4.812	0.025	2.077

The criteria values in the decision matrix are calculated according to the financial ratios listed in Table 2. The data used for financial ratios were obtained from the Public Disclosure Platform (PDP, 2024). In the study, first, the weights of the criteria were determined using the MEREC Method, and then the alternative rankings were calculated via the COBRA Approach.

4.1. Calculation of Criteria Weights with MEREC Method

In this part of the study, criterion weights were determined by the MEREC method. In order to prevent table density and potential confusion, detailed results are presented only for 2023, while the same analytical procedures have been consistently applied to the other years. Table 5 presents the decision matrix for the year 2023.

Table 5. Decision Matrix for 2023

	C1	C2	C3	C4	C5	C6	C7	C8
A1	1.449	1.159	29.645	2.373	1.353	11.691	0.171	12.664
A2	1.418	0.918	33.066	2.024	1.314	7.071	0.091	6.903
A3	1.163	0.850	59.191	0.689	1.197	6.918	0.251	20.942
A4	1.362	1.039	38.951	1.567	0.820	8.263	0.123	15.014
A5	1.507	0.753	38.223	1.616	0.610	2.399	0.018	2.927
A6	1.525	0.685	36.563	1.735	0.843	3.224	0.044	5.193
A7	1.311	0.673	38.558	1.594	1.192	4.888	0.037	3.076
A8	1.152	0.797	74.440	0.343	1.168	3.705	0.084	7.225
A9	0.760	0.531	46.354	1.157	0.803	11.929	0.099	12.266
A10	0.817	0.494	56.623	0.766	0.454	3.735	0.178	39.278
A11	1.295	1.009	44.672	1.239	2.563	14.329	0.201	7.847
A12	1.051	0.764	57.596	0.736	1.598	8.767	0.124	7.736
A13	0.616	0.315	67.359	0.485	1.193	4.812	0.025	2.077

Equation (2) was used to normalise the decision matrix given in Table 5, resulting in the formation of the normalised decision matrix presented in Table 6.

Table 6. Normalised Decision Matrix

	C1	C2	C3	C4	C5	C6	C7	C8
A1	0.425	0.272	0.398	0.145	0.335	0.205	0.104	0.164
A2	0.434	0.343	0.444	0.170	0.345	0.339	0.197	0.301
A3	0.530	0.370	0.795	0.498	0.379	0.347	0.071	0.099
A4	0.452	0.303	0.523	0.219	0.553	0.290	0.145	0.138
A5	0.409	0.418	0.513	0.212	0.743	1.000	1.000	0.710
A6	0.404	0.460	0.491	0.198	0.538	0.744	0.408	0.400
A7	0.469	0.468	0.518	0.215	0.380	0.491	0.487	0.675
A8	0.534	0.395	1.000	1.000	0.388	0.648	0.212	0.288
A9	0.810	0.593	0.623	0.297	0.564	0.201	0.181	0.169
A10	0.753	0.637	0.761	0.448	1.000	0.642	0.100	0.053
A11	0.475	0.312	0.600	0.277	0.177	0.167	0.089	0.265
A12	0.586	0.412	0.774	0.466	0.284	0.274	0.144	0.269
A13	1.000	1.000	0.905	0.709	0.380	0.499	0.720	1.000

With the help of the values in Table 6 and Equation (3), the total performance values (S_i) of the alternatives were found. In the next step, alternative performances (S'_{ij}) were calculated using Equation (4). Table 7 presents the total performance values of the alternatives (S_i) and the specific performance values of a different metric or criterion (S'_{ij}).

Table 7. S_i and S'_{ij} Performance Values

	S_i	S'_{ij}							
		C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
A1	1.371	1.315	1.285	1.311	1.240	1.299	1.265	1.216	1.249
A2	1.214	1.150	1.131	1.151	1.072	1.131	1.130	1.085	1.120
A3	1.219	1.171	1.143	1.202	1.166	1.145	1.138	1.002	1.032
A4	1.245	1.186	1.155	1.197	1.129	1.201	1.152	1.095	1.092
A5	0.768	0.658	0.661	0.688	0.570	0.733	0.768	0.768	0.727
A6	0.988	0.900	0.913	0.920	0.825	0.929	0.960	0.901	0.899
A7	0.965	0.890	0.890	0.900	0.807	0.868	0.895	0.894	0.927
A8	0.890	0.823	0.789	0.890	0.890	0.787	0.844	0.716	0.753
A9	1.105	1.088	1.061	1.065	0.999	1.057	0.963	0.953	0.946
A10	1.055	1.030	1.015	1.031	0.983	1.055	1.016	0.832	0.760
A11	1.320	1.269	1.239	1.285	1.230	1.197	1.193	1.143	1.227
A12	1.119	1.074	1.044	1.098	1.055	1.010	1.007	0.947	1.005
A13	0.476	0.476	0.476	0.460	0.421	0.313	0.361	0.423	0.476

Then, the sum of the absolute deviations (E_j) was calculated using Equation (5). In the last step, the importance weights (w_j) of the criteria were determined by using Equation (6). These values are presented in Table 8.

Table 8. E_j and w_j Values

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
E_j	0.704	0.933	0.536	1.348	1.008	1.043	1.759	1.522
w_j	0.080	0.105	0.061	0.152	0.114	0.118	0.199	0.172

When the results obtained from Table 8 are analyzed, it is seen that the first three criteria with the highest weights are Return on Assets Ratio, Net Profit Margin, and Financing Ratio, respectively. The criteria with relatively low importance weights are the Financial Leverage Ratio and the Current Ratio.

4.2. Ranking Alternatives with the COBRA Method

When the steps of the COBRA Method are analyzed, the first step is the creation of the decision matrix, as in the other MCDM methods. The decision matrix data used in the first stage of the MEREC Method and shown in Table 5 are also valid for the COBRA Method. Since the two methods differ in the data normalization stage, the analysis started with the normalized decision matrix created using Equation (8) and presented in Table 9.

Table 9. Normalized Decision Matrix

	C1	C2	C3	C4	C5	C6	C7	C8
A1	0.950	1.000	0.398	1.000	0.528	0.816	0.684	0.322
A2	0.930	0.792	0.444	0.853	0.513	0.493	0.362	0.176
A3	0.762	0.733	0.795	0.291	0.467	0.483	1.000	0.533
A4	0.893	0.897	0.523	0.660	0.320	0.577	0.492	0.382
A5	0.988	0.650	0.513	0.681	0.238	0.167	0.071	0.075
A6	1.000	0.591	0.491	0.731	0.329	0.225	0.175	0.132
A7	0.860	0.580	0.518	0.671	0.465	0.341	0.146	0.078
A8	0.756	0.688	1.000	0.145	0.456	0.259	0.337	0.184
A9	0.498	0.458	0.623	0.488	0.313	0.833	0.393	0.312
A10	0.536	0.426	0.761	0.323	0.177	0.261	0.711	1.000
A11	0.849	0.871	0.600	0.522	1.000	1.000	0.803	0.200
A12	0.689	0.659	0.774	0.310	0.623	0.612	0.493	0.197
A13	0.404	0.272	0.905	0.204	0.466	0.336	0.099	0.053

By calculating the values in the normalized decision matrix with the criterion weights obtained in the MEREC method, with the help of Equation (9), researchers obtained the weighted normalized decision matrix presented in Table 10.

Table 10. Weighted Normalized Decision Matrix

	C1	C2	C3	C4	C5	C6	C7	C8
A1	0.076	0.105	0.024	0.152	0.060	0.096	0.136	0.055
A2	0.074	0.083	0.027	0.130	0.058	0.058	0.072	0.030
A3	0.061	0.077	0.048	0.044	0.053	0.057	0.199	0.092
A4	0.071	0.094	0.032	0.101	0.036	0.068	0.098	0.066
A5	0.079	0.068	0.031	0.104	0.027	0.020	0.014	0.013
A6	0.080	0.062	0.030	0.111	0.037	0.027	0.035	0.023
A7	0.068	0.061	0.031	0.102	0.053	0.040	0.029	0.013
A8	0.060	0.072	0.061	0.022	0.052	0.030	0.067	0.032
A9	0.040	0.048	0.038	0.074	0.036	0.098	0.078	0.054
A10	0.043	0.045	0.046	0.049	0.020	0.031	0.141	0.172
A11	0.068	0.092	0.036	0.079	0.114	0.118	0.159	0.034
A12	0.055	0.069	0.047	0.047	0.071	0.072	0.098	0.034
A13	0.032	0.029	0.055	0.031	0.053	0.040	0.020	0.009

Based on Equations (10)-(12), the positive ideal (PIS_j), negative ideal (NIS_j) and average solution (AS_j) for the criteria are determined and shown in Table 11.

Table 11. Positive Ideal, Negative Ideal and Average Solution Values

	C1	C2	C3	C4	C5	C6	C7	C8
PIS_j	0.080	0.105	0.024	0.152	0.114	0.118	0.199	0.172
NIS_j	0.032	0.029	0.061	0.022	0.020	0.020	0.014	0.009
AS_j	0.062	0.070	0.039	0.081	0.052	0.058	0.088	0.048

Euclidean and Taxicab distances from the positive ideal, negative ideal, and mean solution were calculated using Equations (15) to (24). The values obtained are presented in Table 12.

Table 12. Positive Ideal, Negative Ideal, Euclidean and Taxicab Distance Values from Average Solution

	$dE(PIS_j)_i$	$dT(PIS_j)_i$	$dE(NIS_j)_i$	$dT(NIS_j)_i$	$dE(AS_j)_i^+$	$dT(AS_j)_i^+$	$dE(AS_j)_i^-$	$dT(AS_j)_i^-$
A1	0.145	0.259	0.225	0.571	0.102	0.223	0.015	0.015
A2	0.209	0.436	0.156	0.394	0.053	0.082	0.027	0.046
A3	0.165	0.381	0.217	0.449	0.119	0.172	0.036	0.039
A4	0.181	0.413	0.160	0.417	0.040	0.091	0.017	0.022
A5	0.283	0.622	0.107	0.208	0.029	0.040	0.094	0.181
A6	0.259	0.571	0.115	0.259	0.035	0.048	0.070	0.141
A7	0.261	0.579	0.107	0.251	0.023	0.029	0.072	0.128
A8	0.261	0.640	0.084	0.190	0.022	0.025	0.070	0.126
A9	0.215	0.525	0.127	0.305	0.040	0.046	0.037	0.077
A10	0.189	0.461	0.210	0.369	0.135	0.184	0.061	0.134
A11	0.162	0.287	0.222	0.543	0.114	0.221	0.014	0.017
A12	0.216	0.516	0.126	0.314	0.027	0.051	0.037	0.055
A13	0.304	0.757	0.040	0.073	0.016	0.017	0.108	0.246

After this step, using Equation (13) and Equation (14), the positive ideal distance ($d(PIS_j)$), negative ideal distance ($d(NIS_j)$) and positive ($d(AS_j)_i^+$) and negative distances ($d(AS_j)_i^-$) from the average solution were calculated. The results obtained here were used in Equation (25) to find dC_i values. Table 13 shows the positive ideal distance, negative ideal distance, positive and negative distances from the average solution, and dC_i values.

Table 13. Positive Ideal, Negative Ideal, Distances from Average Solution and dC_i Values

	$d(PIS_j)$	$d(NIS_j)$	$d(AS_j)_i^+$	$d(AS_j)_i^-$	dC_i
A1	0.150	0.248	0.105	0.015	-0.047
A2	0.224	0.167	0.053	0.027	0.008
A3	0.175	0.235	0.122	0.036	-0.036
A4	0.193	0.172	0.040	0.017	-0.001
A5	0.311	0.111	0.029	0.096	0.067
A6	0.282	0.121	0.036	0.070	0.049
A7	0.285	0.112	0.023	0.073	0.056
A8	0.288	0.087	0.022	0.071	0.062
A9	0.233	0.134	0.041	0.037	0.024
A10	0.203	0.224	0.138	0.062	-0.024
Table 13. Continued					
A11	0.169	0.244	0.117	0.014	-0.044
A12	0.233	0.134	0.027	0.037	0.027
A13	0.340	0.041	0.016	0.110	0.098

The ranking of alternatives is based on their dC_i values. A smaller dC_i value indicates that the alternative option is better. The ranking results of the alternatives calculated by the COBRA method are listed in Table 14, together with the company names and BIST codes.

Table 14. 2023 Ranking Results of Alternatives

Alternatives	Rank	BIST Code	Company Name
A1	1	AKCNS	Akçansa Çimento Sanayi ve Ticaret A.Ş.
A2	6	AKSA	Aksa Akrilik Kimya Sanayii A.Ş.
A3	3	CCOLA	Coca-Cola İçecek A.Ş.
A4	5	CIMSA	Çimsa Çimento Sanayi ve Ticaret A.Ş.
A5	12	EREGL	Ereğli Demir ve Çelik Fabrikaları T.A.Ş.
A6	9	ISDMR	İskenderun Demir ve Çelik A.Ş.
A7	10	KRDMD	Kardemir Karabük Demir Çelik Sanayi ve Ticaret A.Ş.
A8	11	OTKAR	Otokar Otomotiv ve Savunma Sanayi A.Ş.
A9	7	PETKM	Petkim Petrokimya Holding A.Ş.
A10	4	SASA	Sasa Polyester Sanayi A.Ş.
A11	2	TUPRS	Tüpraş-Türkiye Petrol Rafinerileri A.Ş.
A12	8	VESBE	Vestel Beyaz Eşya Sanayi ve Ticaret A.Ş.
A13	13	VESTL	Vestel Elektronik Sanayi ve Ticaret A.Ş.

When the financial performance ranking of the companies in 2023 is analysed in Table 14, the company with the highest financial performance is Akçansa Çimento Sanayi ve Ticaret A.Ş., and the company with the lowest financial performance is Vestel Elektronik Sanayi ve Ticaret A.Ş. In order to avoid excessive density and potential confusion in the tables, and to ensure that the analysis can be more easily followed by readers, the detailed calculation steps are provided only for the year 2023. The same procedures were applied to the remaining years, and the dC_i values together with the ranking results for all years are presented in Table 15.

Table 15. Comparative Results for 2018-2023

	2018		**2019**		**2020**	
	dC_i	**Rank**	dC_i	**Rank**	dC_i	**Rank**
AKCNS	0.038	**7**	0.069	**9**	0.052	**9**
AKSA	0.068	**12**	0.054	**8**	0.016	**7**
CCOLA	0.049	**9**	0.024	**7**	0.010	**4**
CIMSA	0.063	**10**	0.107	**11**	0.056	**10**
EREGL	-0.041	**2**	0.005	**5**	0.012	**5**
ISDMR	-0.093	**1**	-0.038	**2**	-0.049	**3**
KRDMD	0.040	**8**	0.118	**13**	0.138	**13**
OTKAR	0.067	**11**	-0.020	**3**	-0.074	**2**
PETKM	0.034	**6**	0.023	**6**	0.013	**6**
SASA	-0.023	**3**	-0.088	**1**	0.095	**12**
TUPRS	0.017	**5**	0.079	**10**	0.085	**11**
VESBE	0.010	**4**	-0.007	**4**	-0.088	**1**
VESTL	0.106	**13**	0.110	**12**	0.046	**8**
	2021		**2022**		**2023**	
	dC_i	**Rank**	dC_i	**Rank**	dC_i	**Rank**
AKCNS	0.064	**10**	-0.006	**5**	-0.047	**1**
AKSA	-0.041	**7**	-0.036	**2**	0.008	**6**
CCOLA	0.064	**9**	0.037	**9**	-0.036	**3**
CIMSA	-0.223	**2**	-0.112	**1**	-0.001	**5**
EREGL	-0.152	**5**	-0.005	**6**	0.067	**12**
ISDMR	-0.073	**6**	0.005	**7**	0.049	**9**
KRDMD	-0.239	**1**	0.076	**11**	0.056	**10**
OTKAR	-0.167	**3**	0.071	**10**	0.062	**11**
PETKM	-0.166	**4**	0.027	**8**	0.024	**7**
SASA	0.294	**13**	-0.006	**4**	-0.024	**4**
TUPRS	0.212	**12**	-0.015	**3**	-0.044	**2**
VESBE	0.036	**8**	0.092	**12**	0.027	**8**
VESTL	0.155	**11**	0.133	**13**	0.098	**13**

According to Table 15, the financial performance rankings of the companies vary between the years examined. In 2018, the top three companies with the best financial performance were ISDMR, EREGL and SASA showed the highest financial performance, while the companies with the lowest financial performance were VESTL, AKSA, and OTKAR, respectively. In 2019, the top three companies with the best financial performance were SASA, ISDMR, and OTKAR, while the lowest performing companies were KRDMD, VESTL, and CIMSA. In 2020, the three companies with the highest financial performance were VESBE, OTKAR, and ISDMR, while the companies with the lowest financial performance were KRDMR, SASA, and TUPRS. In 2021, the companies with the best financial performance were KRDMR, CIMSA, and OTKAR, while the lowest ones were SASA, TUPRS, and VESTL. In 2022, CIMSA, AKSA, and TUPRS had the best performance, while the companies with the lowest financial performance were VESTL, VESBE, and KRDMD. Finally, in 2023, AKCNS, TUPRS, and CCOLA are the companies with the highest financial performance, while VESTL, EREGL, and OTKAR are the companies with the lowest financial performance. The change in the financial performance rankings of companies between 2018 and 2023 is presented in Chart 1. This period range is important for understanding the performance fluctuations of companies because it includes the period before and after the COVID-19 pandemic.

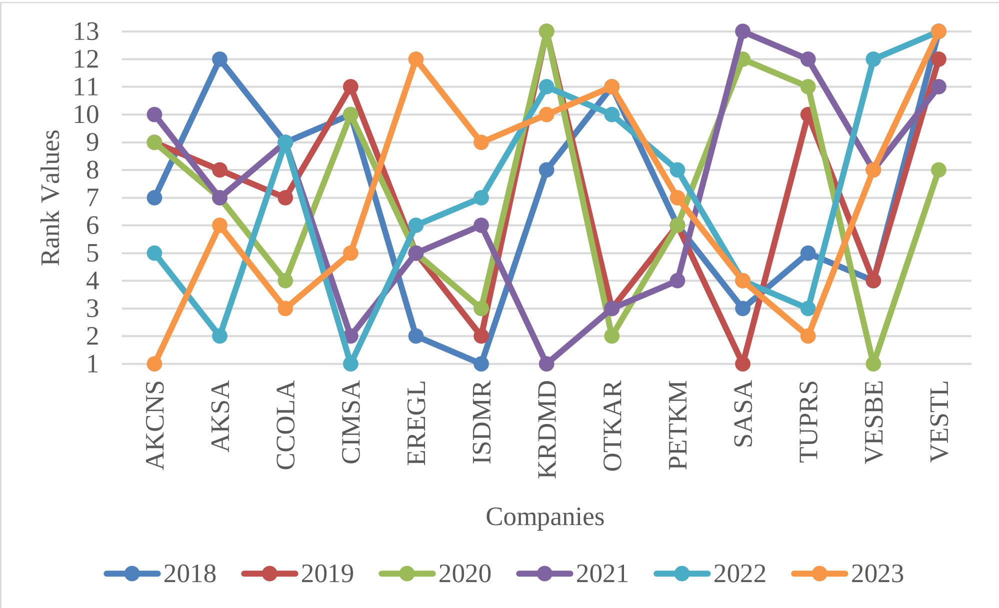

Chart 1. Change in Financial Performance Rankings of Companies in 2018-2023

According to Chart 1, when we look at the processes before and after the COVID-19 pandemic, ISDMR and SASA were the top three companies with the best financial performance ranking in 2018 and 2019 before the pandemic, while OTKAR in 2020 and 2021 during the pandemic, and TUPRS in 2022-2023 after the pandemic.

5. Sensitivity Analysis

Sensitivity analysis helps analyze the effect of changes in criteria data by comparing different scenarios, and the results obtained from these scenarios according to changing conditions (Goodridge, 2016: 27). With sensitivity analysis, the strength of the model can be measured by examining the effect of changes in input data on the results obtained with multi-criteria models

(Karande et al., 2016: 406). In the literature, different techniques are used during the sensitivity analysis stage of MCDM studies (Demir et al., 2024). In this study, sensitivity analyses were carried out based on the comparison of the results obtained from different MCDM techniques, as it is a preferred approach in the literature (Badi et al., 2023; Bonab et al., 2023; Liu et al., 2023). Firstly, the consistency of the results obtained from the COBRA method, which is the ranking model of the study, was tested. The rankings obtained from the MEREC-COBRA integrated model were compared with the rankings obtained from different MCDM methods. In this comparison, Spearman's rank correlation coefficient (r_S) was employed to assess the consistency between the results. At this stage, the MEREC method was used for weighing the criteria, and the results are shown in Table 16.

Table 16. Ranking Results Obtained with MEREC Weighted Different MCDM Methods

	2018					2019				
	COBRA	**EDAS**	**ARAS**	**COCOSO**	**WASPAS**	**COBRA**	**EDAS**	**ARAS**	**COCOSO**	**WASPAS**
A1	7	5	7	7	6	9	9	9	8	9
A2	12	10	10	10	10	8	8	8	9	8
A3	9	9	9	9	9	7	6	6	4	6
A4	10	11	11	12	11	11	11	11	11	13
A5	2	2	2	2	2	5	3	3	2	3
A6	1	1	1	1	1	2	1	2	1	1
A7	8	7	8	8	8	13	12	12	12	12
A8	11	12	12	11	12	3	4	4	7	5
A9	6	6	6	6	5	6	7	7	5	7
A10	3	3	3	3	3	1	2	1	6	2
A11	5	8	5	5	7	10	10	10	10	10
A12	4	4	4	4	4	4	5	5	3	4
A13	13	13	13	13	13	12	13	13	13	11
r_s	-	0.945	0.984	0.978	0.967	-	0.967	0.973	0.819	0.951
	2020					**2021**				
	COBRA	**EDAS**	**ARAS**	**COCOSO**	**WASPAS**	**COBRA**	**EDAS**	**ARAS**	**COCOSO**	**WASPAS**
A1	9	8	8	8	8	10	10	10	10	10
A2	7	7	7	7	7	7	7	7	7	7
A3	4	5	5	5	5	9	9	9	9	9
A4	10	10	10	10	10	2	2	2	2	2
A5	5	4	4	4	4	5	4	4	4	4
A6	3	1	1	1	1	6	6	6	6	6
A7	13	13	13	13	13	1	1	1	1	1
A8	2	3	3	3	3	3	5	5	5	5
A9	6	6	6	6	6	4	3	3	3	3
A10	12	12	12	12	12	13	13	13	13	13
A11	11	11	11	11	11	12	12	12	12	12
A12	1	2	2	2	2	8	8	8	8	8
A13	8	9	9	9	9	11	11	11	11	11
r_s	-	0.973	0.973	0.973	0.973	-	0.984	0.984	0.984	0.984
	2022					**2023**				
	COBRA	**EDAS**	**ARAS**	**COCOSO**	**WASPAS**	**COBRA**	**EDAS**	**ARAS**	**COCOSO**	**WASPAS**
A1	5	5	5	6	4	1	1	1	1	1
A2	2	2	2	3	2	6	6	6	5	5
A3	9	9	9	8	9	3	3	3	3	3
A4	1	1	1	1	1	5	5	5	4	4
A5	6	4	4	4	5	12	12	12	11	12
A6	7	6	6	5	6	9	9	9	9	9
A7	11	10	10	10	10	10	10	10	10	10
A8	10	11	11	12	11	11	11	11	12	11
A9	8	8	8	7	7	7	7	7	8	8
A10	4	7	7	9	8	4	4	4	7	6
A11	3	3	3	2	3	2	2	2	2	2
A12	12	12	12	11	12	8	8	8	6	7
A13	13	13	13	13	13	13	13	13	13	13
r_s	-	0.956	0.956	0.879	0.940	-	1.000	1.000	0.951	0.978

According to Table 16, the ranking results obtained by applying the criteria weights found by the MEREC method to different MCDM methods displayed small deviations, for each year considered. For the years 2020 and 2021, the rankings obtained with the EDAS, ARAS, COCOSO, and WASPAS methods were the same, while the rankings obtained with the EDAS and ARAS methods in 2022, and the COBRA, EDAS, and ARAS methods in 2023, were the same. The Spearman correlation coefficient being greater than 0.8 between 2018 and 2023 indicates that there is a high positive relationship between COBRA and other MCDM methods. Thus, it can be concluded that the proposed approach provides results consistent with other ranking methods.

In the second stage, the consistency of the weights obtained from the MEREC method, which is the criterion weighting model of the study, was analyzed. In this stage, where the COBRA approach was used as the ranking method, the effect of different weighting methods on the result was investigated and the findings are presented in Table 17.

Table 17. COBRA Method Rankings Obtained with Different Weighting Methods

Year	2018						2019					
	MEREC	ENTROPY	CRITIC	SD	CILOS	EQUAL WEİGHTİNG	MEREC	ENTROPY	CRITIC	SD	CILOS	EQUAL WEİGHTİNG
A1	7	6	8	8	8	8	9	9	7	9	9	9
A2	12	11	9	11	12	11	8	8	10	10	10	10
A3	9	9	7	7	10	7	7	6	3	4	5	6
A4	10	10	10	12	11	12	11	11	11	11	11	11
A5	2	2	4	2	3	2	5	3	8	5	7	2
A6	1	1	2	1	1	1	2	2	5	1	1	1
A7	8	5	11	9	7	9	13	12	13	13	13	13
A8	11	12	12	10	9	10	3	4	9	8	8	7
A9	6	8	5	6	6	6	6	7	2	3	4	5
A10	3	3	6	3	2	3	1	1	6	6	3	4
A11	5	7	1	4	5	4	10	10	4	7	6	8
A12	4	4	3	5	4	5	4	5	1	2	2	3
A13	13	13	13	13	13	13	12	13	12	12	12	12
r_s	-	0.945	0.846	0.962	0.973	0.962	-	0.973	0.549	0.764	0.819	0.874

Table 17. Continued

Year	2020						2021					
	MEREC	ENTROPY	CRITIC	SD	CILOS	EQUAL WEİGHTİNG	MEREC	ENTROPY	CRITIC	SD	CILOS	EQUAL WEİGHTİNG
A1	9	7	5	7	8	7	10	10	11	11	10	11
A2	7	8	9	8	7	8	7	8	9	9	8	9
A3	4	5	3	4	5	5	9	7	8	6	9	7
A4	10	9	10	9	10	10	2	3	2	4	5	4
A5	5	2	6	5	6	3	5	1	6	3	3	3
A6	3	1	4	1	2	1	6	2	3	2	4	2
A7	13	13	13	13	13	13	1	5	4	5	2	5
A8	2	4	7	6	3	6	3	6	10	7	6	6
A9	6	6	2	3	4	4	4	4	1	1	1	1
A10	12	12	12	12	12	12	13	13	13	13	13	13
A11	11	11	8	10	11	9	12	11	7	10	11	10
A12	1	3	1	2	1	2	8	9	5	8	7	8
A13	8	10	11	11	9	11	11	12	12	12	12	12
r_s	-	0.912	0.775	0.874	0.973	0.868	-	0.819	0.676	0.769	0.890	0.802
Year	2022						2023					
	MEREC	ENTROPY	CRITIC	SD	CILOS	EQUAL WEİGHTİNG	MEREC	ENTROPY	CRITIC	SD	CILOS	EQUAL WEİGHTİNG
A1	5	7	6	6	8	6	1	3	2	2	1	2
A2	2	2	3	3	6	3	6	7	6	5	5	5
A3	9	9	8	8	3	8	3	2	3	3	3	3
A4	1	1	1	1	4	1	5	5	5	4	4	4
A5	6	3	4	4	2	4	12	12	11	11	7	11
A6	7	4	5	5	5	5	9	10	9	9	6	9
A7	11	10	10	10	9	10	10	11	10	10	8	10
A8	10	11	12	12	10	12	11	9	12	12	10	12
A9	8	8	7	7	7	7	7	6	7	7	12	8
A10	4	6	9	9	12	9	4	1	4	6	11	6
A11	3	5	2	2	1	2	2	4	1	1	2	1
A12	12	12	11	11	11	11	8	8	8	8	9	7
A13	13	13	13	13	13	13	13	13	13	13	13	13
r_s	-	0.912	0.879	0.879	0.549	0.879	-	0.929	0.989	0.973	0.681	0.967

According to Table 17, the COBRA method rankings obtained with six different weighting methods together with the MEREC method differed on a yearly basis. In 2018, the ranking results obtained with SD and Equal Weighting methods were the same, while in 2022, the rankings obtained with CRITIC, SD, and Equal Weighting methods were the same. In Table 17, the consistency of the rankings obtained through the COBRA method with different weighting schemes is assessed using Spearman's rank correlation coefficients (r_S). The majority of the coefficients are above 0.8, suggesting that the rankings generated by alternative weighting approaches are strongly and positively correlated.

6. Discussion and Conclusion

In this study, the financial performance of 13 companies operating in the manufacturing sector and included in the BIST Participation Sustainability Index between 2018 and 2023 was evaluated using MCDM methods. The selection of the manufacturing sector was influenced by the presence of companies in the relevant index. In the analysis of the study, eight financial ratios under the four main headings of liquidity, financial structure, activity, and profitability ratios were used as criteria. Data on these criteria were obtained from the Public Disclosure Platform. The MEREC method was utilized to determine the importance weights of the criteria. When the criterion weights are analyzed, it is observed that the highest criterion weight belongs to the net profit margin for 2018 and the return on assets ratio for 2019-2023. It is understood that profitability ratios are the most effective ratios in determining the financial performance of manufacturing sector companies. The financial leverage ratio was the lowest criterion weight among the financial structure ratios, analyzed over all years. After determining the criterion weights, the performance ranking of the companies was conducted using the COBRA method. It was observed that the ranking results obtained with the MEREC-COBRA model varied over the years. In 2018, the company with the highest financial performance was found to be ISDMR, SASA in 2019, VESBE in 2020, KRDMD in 2021, CIMSA in 2022, and AKCNS in 2023. When the literature on financial performance measurement is examined, limited studies on the companies included in the BIST Participation Sustainability Index are observed. Among the known studies, Kılıçarslan (2022) evaluated the financial performance of all companies registered in the index for the years 2016-2021 with the help of the Bulut Index and the Aras methods, using 12 financial ratios. In another study by Güçlü and Göktaş (2023), 10 financial ratios were used with the data obtained from the 2022 year-end financial statements of 11 manufacturing sector companies included in the relevant index. Criteria weights were determined by using the entropy method, and the results obtained by ranking the alternatives using the Probability Evaluation System (PES) and TOPSIS methods were compared. The financial performance ranking obtained as a result of the PES method is as follows: AKSA, TUPRS, SUNTK, AKCNS, ISDMR, EREGL, PNSUT, KRDMD, KARSN, VESBE, VESTL. According to the TOPSIS method results, the financial performance ranking is AKSA, TUPRS, SUNTK, AKCNS, EREGL, ISDMR, KRDMD, PNSUT, KARSN, VESBE, and VESTL. This study, unlike the study of Güçlü and Göktaş (2023), as of September 2024, the financial performance of 13 manufacturing companies included in the BIST Participation Sustainability Index between 2018-2023 in terms of the COVID-19 Pandemic processes. As a method, in Güçlü and Göktaş (2023), the Entropy method was used to calculate the criteria weights, and the PES and TOPSIS methods were used to rank the alternatives, and the ranking results obtained were compared. In this study, the newly introduced MEREC and COBRA methods were used. Criterion weights were determined by the MEREC method, and alternatives were ranked by the COBRA method. In addition, to measure the validity and robustness of the model proposed in the study, a two-stage sensitivity analysis was performed to compare the results obtained from different methods. Firstly, the results obtained with the COBRA method were compared with the results obtained from different MCDM methods (EDAS, ARAS, COCOSO, WASPAS) used in ranking the alternatives. Then, in order to measure the strength of the related model, the results obtained by using the criteria weights from the MEREC method were compared with the results obtained from different MCDM methods (Entropy, CRITIC, SD, CILOS, Equal Weighting) used in criteria weighting. In general, small differences were observed in the rankings obtained in these two stages. The Spearman's correlation test was performed to determine the relationship between the rankings. According to the results of this test, high positive relationships were observed between the rankings, and the suitability of the model used in the study was also determined.

It is believed that the outputs of the study have important implications for the firms included in the analysis and investors. In addition to allowing firms to compare their performances with those of other firms, it enables managers to monitor the course of certain financial ratios over the years. It provides an idea for taking necessary precautions and corrective measures. For investors, it provides decision support in investment planning for the relevant index. In the related literature, it is emphasized that the index is suitable for an investor profile with high Islamic sensitivity, and the expansion rate of the index is an issue that should not be ignored. The findings were not only compared with the existing literature but also evaluated in the context of Turkey's recent macroeconomic conditions and sectoral dynamics. For instance, in 2020, disruptions in production and supply chains due to the COVID-19 pandemic negatively affected the financial performance of certain firms. In 2021 and 2022, the sharp rise in energy costs led to declines in profitability ratios, particularly for companies operating in energy-intensive industries. Exchange rate fluctuations directly influenced the performance of firms with high dependence on imported inputs or those oriented toward exports. Moreover, inflationary pressures strained firms' financial structures, while favoring those with strong cash flows. In this context, the performance rankings reflect not only the internal dynamics of firms but also the impact of macroeconomic conditions and sector-specific characteristics. However, the most important limitation of the study is the range of years subject to analysis and the criteria used, which are based on financial ratios. It should be kept in mind that different performance rankings may be obtained when different sets of criteria are used.

The most significant implication for managers is that profitability ratios emerged as the key determinant of corporate performance during the 2019–2023 period. In particular, the fact that return on assets carried the highest criterion weight indicates that managers should design their financial strategies around the efficient utilization of assets and the sustainability of profitability. Accordingly, cost control, productivity-enhancing investments, and innovative business models that support profitability stand out as priority strategic areas. From the investors' perspective, the finding that the highest-performing companies varied across years is particularly critical. The prominence of ISDMR in 2018, SASA in 2019, VESBE in 2020, KRDMD in 2021, ÇİMSA in 2022, and AKCNS in 2023 demonstrates that different sub-sectors of the manufacturing industry (e.g., iron and steel, chemicals, and cement) exhibited strong performances at different times, particularly during and after the pandemic. This suggests that, rather than focusing on a single company or sub-sector, investment decisions should be guided by flexible and diversified portfolio strategies that take into account period-specific trends and sectoral dynamics.

The findings of the study demonstrate the effectiveness of multi-criteria decision-making approaches in financial performance analysis. In this context, for companies in the manufacturing sector to gain a sustainable competitive advantage, the use of these methods in financial performance management and their integration into corporate decision-making processes are crucial. Identifying financial strategies aligned with sustainability principles and, in this regard, developing performance-based incentive systems by policymakers will enhance firms' competitive power. The integrated MEREC-COBRA approach, the main model of the study, is proposed as an applicable model for optimizing decision-making processes of policymakers.

For future studies, since the BIST Participation Sustainability Index is a new index and there are very few studies on it in the literature, the financial performances of companies operating in different sectors can be examined. In addition, financial ratios can be diversified, and new studies can be carried out using different MCDM methods in the literature. In this study, objective MCDM techniques were used both in determining the criteria weights and in performance rankings. The results can be compared with the studies conducted using subjective methods.

Declaration of Research and Publication Ethics
This study which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researcher’s Contribution Rate Statement
The authors declare that they have contributed equally to the article.

Declaration of Researcher’s Conflict of Interest
There is no potential conflicts of interest in this study.

References

Acar, E. and Sarıyer, G. (2021). Financial performance evaluation of Turkish basic metal industry: Combining AHP and TOPSIS. *International Journal of Economic and Administrative Studies,* 31, 113-128. doi:10.18092/ulikidince.734976

Akbulut, R. and Rençber, Ö.F. (2015). A research on financial performance of manufacturing businesses that are traded on BIST. *The Journal of Accounting and Finance,* 65, 117-136. https://doi.org/10.25095/mufad.396520

Akyüz, F. and Yeşil, T. (2017). Analysing the financial performance of the companies operating by registered in production sector of BIST Sustainability Index. *Journal of Academic Research and Studies*, 9(16), 61-78. https://doi.org/10.20990/kilisiibfakademik.270635

Akyüz, F., Yeşil, T., Kara, İ. and Ersoy, G. (2018). Determination of financial performances of multilayer decisionmaking methods of printing and publishing businesses of paper and paper products processed at BIST. *Business & Management Studies: An International Journal*, 6(3), 293-314. doi:10.15295/bmij.v6i3.354

Arman, K., Çıbır, M. and Kundakcı, N. (2022). Analysis of financial performance of companies with fuzzy PIPRECIA and MARCOS methods: An application in BIST Textile, Leather Index. *The World of Accounting Science*, 24(4), 800-826. https://doi.org/10.31460/mbdd.985476

Arslan, Ö. (2024). Evaluation of financial performance of textile apparel businesses traded on BIST using the COPRAS method. *Journal of Business Research-Turk*, 16(1), 381-391. https://doi.org/10.20491/isarder.2024.1797

Asker, V. (2022). Financial performance analysis by CRITIC-based COCOSO method before and during the Covid-19 pandemic: An application in the manufacturing sector. *Journal of Financial Politic & Economic Reviews,* 59(662). Retreived from https://dergipark.org.tr/tr/pub/fpeyd

Asker, V. (2024). Financial performance analysis using the MEREC-Based COBRA Method: An application to traditional and low-cost airlines. *Gospodarka Narodowa. The Polish Journal of Economics*, 318(2), 35-52. https://doi.org/10.33119/GN/184315

Aytekin, S. and Sakarya, Ş. (2013). The evaulation of the financial performances of the food enterprises traded on BIST with TOPSIS method. *Journal of Management and Economics Research*, 21. http://dx.doi.org/10.11611/JMER191

Badi, I., Pamučar, D., Stević, Ž. and Muhammad, L.J. (2023). Wind farm site selection using BWM-AHP-MARCOS method: A case study of Libya. *Scientific African*, 19, e01511. https://doi.org/10.1016/j.sciaf.2022.e01511

Bakırcı, F., Shiraz, S.E. and Sattary, A. (2014). Financial performance analysis of iron, steel metal industry sector companies in the Borsa Istanbul: DEA super efficiency and TOPSIS methods. *Ege Academic Review*, 14(1), 9. Retrieved from https://dergipark.org.tr/en/pub/eab

Bardi, Ş. (2023). Financial performance analysis with Gray Relational Analysis method: BIST stock manufacturing sub-sectors application. *The Journal of Social Sciences Academy,* 6(2), 145–167. https://doi.org/10.38004/sobad.1333980

BIST. (2024). *Borsa Istanbul.* Retrieved from https://borsaistanbul.com/en/index/1/3/participation

Bonab, S.R., Ghoushchi, S.J., Deveci, M. and Haseli, G. (2023). Logistic autonomous vehicles assessment using decision support model under spherical fuzzy set integrated Choquet Integral approach. *Expert Systems with Applications*, 214, 119205. https://doi.org/10.1016/j.eswa.2022.119205

Bozdoğan, T., Odabaş, A. and Çetin, Ö.O. (2023). Financial performance of BIST-Cement companies analysis by TOPSIS and ELECTRE methods. *Dumlupınar University Journal of Social Sciences,* 78, 491–510. https://doi.org/10.51290/dpusbe.1368085

Brescia, V., Sa'ad, A.A., Alhabshi, S.M.B.S.J., Hassan, R.B. and Lanzalonga, F. (2021). Exploring sustainability from the Islamic finance perspective. *European Journal of Islamic Finance*, 19, 45-53. doi:10.13135/2421-2172/6107

Çanakçıoğlu, M. (2022). A model suggestion for financial performance analysis of companies in the BIST XTEKS Index. *Financial Analysis*, 32, 75-107. Retrieved from https://ismmmo.org.tr/Yayinlar/Mali-Cozum-Dergisi--1

Cebeci, G. and Özbilgin, İ.G. (2015). Evaluation of the companies in Borsa Istanbul Information Technology Index in terms of corporate governance and financial performance. *Gazi University Journal of Social Sciences,* 2(4), 47- 64. Retrieved from https://dergipark.org.tr/tr/pub/asbider

Çıtak, Ö. and Ünlü, U. (2024). Evaluation of sustainability reports of banks traded on BIST with MCDM method. *Alanya Academic Review Journal,* 8(3), 840-857. doi:10.29023/alanyaakademik.1474388

Çolak, Z. (2023). Determination of financial performance rankings of the enterprises in the BIST Basic Metal Index (XMANA) with TOPSIS method. *Başkent University Journal of Faculty of Commercial Sciences*, 7(1), 1-20. Retrieved from https://dergipark.org.tr/en/pub/jcsci

Demir, G., Chatterjee, P. and Pamucar, D. (2024). Sensitivity analysis in multi-criteria decision making: A state-of-the-art research perspective using bibliometric analysis. *Expert Systems with Applications*, 237, 121660. https://doi.org/10.1016/j.eswa.2023.121660

Ergün, Ü.R. and Bulut, E. (2024). Business performance and financial performance measurement under the influence of financial contagion: An application in an iron-steel industry operation. *Journal of Süleyman Demirel University Institute of Social Sciences*, 49, 1-44. https://doi.org/10.61904/sbe.1433674

Ersoy, N. (2023). Financial performance measurement in BIST chemicals, petroleum, rubber and plastic products industry with SECA method. *ODU Journal of Social Sciences Research,* 13(2), 1975–1998. https://doi.org/10.48146/odusobiad.1164930

Gedik, Y. (2020). Sustainability and sustainable development with social, economic and environmental dimensions. *International Journal of Economics, Politics, Humanities and Social Sciences*, 3(3), 196-215. Retrieved from https://dergipark.org.tr/en/pub/ijephss

Ghoul, W. and Karam, P. (2007). MRI and SRI mutual funds: A comparison of Christian, Islamic (morally responsible investing), and socially responsible investing (SRI) mutual funds. *The Journal of Investing,* 16(2), 96-102. doi:10.3905/joi.2007.686416

Göktaş, F. (2024). A robust theoretical approach for sustainable portfolio selection: An application on BIST participation sustainability stocks. *Mehmet Akif Ersoy University Journal of Social Sciences Institute,* 39, 60-72. doi:10.20875/makusobed.1436718

Göktaş, F. and Güçlü, F. (2023). Fuzzy portfolio selection with BIST Participation Sustainability Index stocks. *Journal of Economy, Business and Management*, 7(2), 223-239. doi:10.7596/jebm.31122023.002

Goodridge, W.S. (2016). Sensitivity analysis using Simple Additive Weighting method. *International Journal of Intelligent Systems and Applications*, 8(5), 27-33. doi:10.5815/ijisa.2016.05.04

Güçlü, F. (2019). The rise of environmental consciousness in Islamic finance: Green sukuk. In C. Aydin and B. Darici (Eds.), *Handbook of energy and environment policy* (pp. 245-259). Berlin: Peter Lang. https://doi.org/10.3726/b16350

Güçlü, F. and Göktaş, F. (2023). Analysis of financial performance of manufacturing firms listed on the BIST Participation Sustainability Index by Entropy weighted TOPSIS and PES methods. *Journal of International Banking Economy and Management*, 6(2), 112-135. doi:10.52736/ubeyad.1394258

Güleç, Ö.F. and Özkan, A. (2018). Evaluation of financial performance with grey relational analysis method: A research on BIST cement companies. *Accounting and Auditing Review,* 18(54), 77-96. Retrieved from https://dergipark.org.tr/tr/pub/mdbakis

Işıldak, M.S. (2018). Financial performance analysis by TOPSIS method of weaving, clothing and leather manufacturing in BIST. *University of Dicle, Journal of Faculty of Economics and Administrative Sciences,* 8(16), 116-130. Retrieved from https://dergipark.org.tr/en/pub/duiibfd

Karande, P., Zavadskas, E. and Chakraborty, S. (2016). A study on the ranking performance of some

MCDM methods for industrial robot selection problems. *International Journal of Industrial Engineering Computations*, 7(3), 399-422. doi:10.5267/j.ijiec.2016.1.001

Karatepe, S. (2008). Reputation management: Confidence creation in public relations. *Electronic Journal of Social Sciences,* 7(23), 77-97. Retrieved from https://dergipark.org.tr/en/pub/esosder

Kavas, Y.B. (2025). Financial performance analysis of BIST Basic Metal Industry Sector (XMANA) enterprises with PROMETHEE II and WASPAS methods. *Nevşehir Hacı Bektaş Veli University Journal of ISS,* 15(1), 372–394. https://doi.org/10.30783/nevsosbilen.1520830

Kayalı, C.A. and Aktaş, İ. (2018). Performance evaluation and analysis through the TOPSIS method of firms in the automotive sector trading in BIST. *Karabuk University Journal of Institute of Social Sciences,* 8(1), 43-59. Retrieved from https://dergipark.org.tr/tr/pub/johut

Kendirli, S. and Yıldırım, M.V. (2022). Investigation of financial performances of automotive manufacturing sector companies registered in BIST with TOPSIS method. *Global Journal of Economics and Business Studies*, 11(21), 87-97. Retrieved from https://dergipark.org.tr/en/pub/paradigmaiiad

Keshavarz-Ghorabaee, M., Amiri, M., Zavadskas, E.K., Turskis, Z. and Antucheviciene, J. (2021). Determination of objective weights using a new method based on the removal effects of criteria (MEREC). *Symmetry*, 13(4), 525. https://doi.org/10.3390/sym13040525

Kılıçarslan, A. (2022). Financial performance analysis for Borsa Istanbul Sustainability Participation Index companies. In Y. A. Ünvan (Ed.), *Economics and administrative sciences: Research, methodology and evaluation* (pp. 1-28). Livre de Lyon.

Krstić, M., Agnusdei, G.P., Miglietta, P.P., Tadić, S. and Roso, V. (2022). Applicability of industry 4.0 technologies in the reverse logistics: A circular economy approach based on comprehensive distance based ranking (COBRA) method. *Sustainability*, 14(9), 5632. https://doi.org/10.3390/su14095632

Küçükönder, H. and Şişmanoğlu, E. (2020). An alternative evaluation framework based on MCDM methods for evaluation of financial performance of companies in the textile and leather index of Istanbul Stock Exchange (BIST). *Financial Analysis*, 30(159). Retrieved from https://ismmmo.org.tr/Yayinlar/Mali-Cozum-Dergisi--1

Liu, A., Li, Z., Shang, W.L. and Ochieng, W. (2023). Performance evaluation model of transportation infrastructure: Perspective of COVID-19. *Transportation Research Part A: Policy and Practice*, 170, 103605. https://doi.org/10.1016/j.tra.2023.103605

Meydan, C., Yıldırım, B.F. and Senger, Ö. (2016). Evaluation of the financial performance of food and beverage companies traded on BIST using grey relational analysis. *The Journal of Accounting and Finance*, 69, 147-171. https://doi.org/10.25095/mufad.396668

Oğuz, A. and Satır, H. (2024). Analysing profitability performance with the integrated MEREC-COBRA method: The case of BIST retail companies. *Business and Economics Research Journal*, 15(1), 33- 50. doi:10.20409/berj.2024.433

Ok, Ş. and Göktaş, F. (2024). A holistic view for corporate sustainability analysis an application on BIST Participation Sustainability Index service sector companies. *Journal of Business Research-Turk,* 16(2), 1067-1080. https://doi.org/10.20491/isarder.2024.1843

Özarı, Ç. and Çanakçıoğlu, M. (2025). Analysis of the financial performance of vehicle manufacturing companies listed on Borsa Istanbul. *Financial Analysis,* 35(187). Retrieved from https://ismmmo.org.tr/Yayinlar/Mali-Cozum-Dergisi--1

Pala, O. (2023). Financial performance analysis in the food industry with SD and WISP approaches. *Journal of Doğuş University*, 24(1), 59-79. https://doi.org/10.31671/doujournal.1118061

Pala, O., Atçeken, Ö., Omurtak, H. and Şimşir, B. (2024). Financial performance analysis with LODECI and CRADIS in BIST Cement industry. *Alanya Academic Review Journal*, 8(3), 956–970. https://doi.org/10.29023/alanyaakademik.1452960

PDP. (2024). *Public disclosure platform.* Retrieved from https://www.kap.org.tr/en/Endeksler

Polat, H. (2011). Manufacturing industry in economy of Turkey. *Journal of Dicle University Faculty of Economics and Administrative Sciences*, 1(2), 24-39. Retrieved from http://dergipark.org.tr/en/pub/duiibfd

Popović, G., Pucar, Đ. and Smarandache, F. (2022). MEREC-COBRA approach in e-commerce development strategy selection. *Journal of Process Management and New Technologies*, 10(3-4), 66-74. https://doi.org/10.5937/jpmnt10-41073

Şahin, A. and Sarı, E.B. (2019). Comparison of financial and stock exchange performance of BIST-manufacturing companies with ENTROPI based TOPSIS and VIKOR methods. *Journal of Accounting and Taxation Studies*, 12(2), 255-270. https://doi.org/10.29067/muvu.340678

Sarıkamış, C. (2007). Development of ratio analyze. *Journal of Accounting and Finance*, 33, 44-45. Retrieved from https://dergipark.org.tr/en/pub/mufad

Strategy and Budget Presidency. (2018). *Manufacturing industry policies. Ankara: Eleventh development plan, special expertise commission report* (Publication No. KB:3031-ÖİK:813). Retrieved from https://www.sbb.gov.tr/wp-content/uploads/2022/08/Imalat-Sanayii-Politikalari-Ozel-Ihtisas-Komisyonu-Raporu.pdf

Süzülmüş, S. (2025). Financial performance evaluation with CRITIC-based COPRAS and MABAC methods in textile industry. *Bingöl University Journal of Social Sciences Institute*, 29, 214-234. https://doi.org/10.29029/busbed.1581938

Vatansever, K. (2024). From quality to quantity orientation: A perspective in the context of university rankings and a model proposal. In Ş. Sevim (Ed.), *Current business research 5*(pp. 153–171). Ankara: Eğitim Publishing.

Yıldırım, M., Bal, K. and Doğan, M. (2021). Financial performance analysis by grey relational analysis method: An application on iron and steel companies traded in BIST. *The World of Accounting Science*, 23(1), 122–143. https://doi.org/10.31460/mbdd.788840