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Evaluation of Financial Performance of BIST Participation Banks: CAMELS and Multi-Criteria Decision Making (MCDM) Approach

(Research Article)

BIST Katılım Bankaları'nın Finansal Performanslarının Değerlendirilmesi: CAMELS ve Çok Kriterli Karar Verme Yaklaşımı

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Emre BULUT[1], Ahmed İhsan ŞİMŞEK[2]

[1] Dr., Fırat Üniversitesi, ebulut@firat.edu.tr, Orcid No: 0000-0002-2884-1405
[2] Dr., Fırat Üniversitesi, aisimsek@firat.edu.tr, Orcid No: 0000-0002-2900-3032

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ÖZET

This study presented an evaluation of the financial performances of six Turkish participation banks with feats of being registered in Borsa Istanbul for the year 2023. The analysis employed 20 different financial ratios using the CAMELS rating. The weighting method of this study was determined to be the CRITIC approach. The financial performances of the 6 participation banks traded in BIST were performed with the weighting method of the CAMELS rating and the CRITIC approach. The performance evaluation was done with the ARAS, TOPSIS, and COPRAS methodologies. As can be observed from the tables, it is clear that EMLAK Katılım Bank has the highest performance in all three methods. Making an evaluation, one can safely argue that the participation banks' financial performance provides similar results in the three different ways. The similarity, plus the reliability, and the validity of these analyses conducted in this study are that the utilization of the TOPSIS, COPRAS, and ARAS approaches yield similar results.

***Anahtar Kelimeler**:*
Çok Kriterli Karar Verme, CRITIC, Katılım Bankaları, Finansal Performans, CAMELS

ÖZET

Bu çalışmada, Borsa İstanbul'da (BİST) işlem gören altı Türk katılım bankasının 2023 yılına ait finansal performansları CAMELS kriterleri çerçevesinde oluşturulmuş olan 20 adet finansal oran kullanılarak değerlendirilmiştir. Çalışmada ağırlıklandırma yöntemi olarak CRITIC yöntemi kullanılmıştır. CAMELS kriterleri CRITIC yöntemi ile ağırlıklandırldıktan sonra BİST'te işlem gören 6 katılım bankasının finansal performansları ARAS, TOPSIS ve COPRAS yöntemleri kullanılarak değerlendirilmiştir. Elde edilen sonuçlar incelendiğinde kullanılan her üç yöntem için de EMLAK Katılım Bankası'nın en iyi performansa sahip banka olduğu ortaya konulmuştur. Yapılan analizler sonucunda katılım bankalarının finansal performanslarının her üç yöntem için de benzer sonuçlar ürettiği görülmektedir. TOPSIS, COPRAS ve ARAS yöntemleri ile yapılan analizlerin benzer sonuçlar vermesi bu çalışmada yapılan analizlerin tutarlılığı, güvenilirliğini ve geçerliliğini artırmaktadır.

1. INTRODUCTION

In Turkey, changes have taken place in the banking sector over the past few years, when new banking models have appeared. Participation banks have become the point of interest because of their unique financial methods and an increasing array of market assets. The participation banks work beside traditional financial institutions and offer an alternative banking system. This new type of bank relies on profit and loss sharing, ethical investments, and mudaraba agreements. The appearance and expansion of the participation banks integrated into Turkey banking markets necessitates an in-depth analysis of their financial activities.

When participation banks were created in 1983 in Turkey, they were referred to as Special Finance Institutions. Ten years ago, under article no. 5411 of the Banking Act, these institutions became known as participation banks. In Turkey, preferred Islamic banking is called participation banking which is based on profit-sharing and risk-sharing. This method is also globally known as Islamic banking and interest-free banking. (Parlakkaya and Çürük, 2011; Bulut and Er, 2012; Karakaya, 2020).

Evaluating the financial performance of participation banks is inherently intricate due to their unique operating principles and financial products (Islam and Shohidul, 2018). Conventional financial metrics, often used for traditional banks, may not fully capture the operational intricacies and financial health of participation banks. Hence, it is necessary to use sophisticated analytical methods that can efficiently handle several factors at the same time in order to provide a thorough evaluation of performance.

Due to the unpredictable environment faced by banking sectors different risks threaten their performance. Many analytical, statistical, and quantitative techniques determine efficiency of performance. Given these instruments for measuring, the CAMELS framework is one of the most popular in that sector. It assesses a bank's advantages and weaknesses. Regulatory authorities utilize the CAMELS model to analyze banks' financial stability (Abuzarqa and Tarnoczi, 2021). This model considers capital sufficiency, asset quality, management efficiency, bank profitability, liquidity management, and sensitivity to market risk. All prior factors' initial letters are in the model name.

Though originally designed for commercial banks in the United States, the CAMELS system has progressively gained acceptance among banking regulatory and supervisory bodies in other countries and is now extensively used globally. Nations have implemented diverse modifications to the CAMELS set of criteria according to their own economic circumstances and dynamics. Furthermore, the CAMELS criteria have been adapted to accommodate the unique features of innovative financial institutions as participation banks (Cole and Wu, 2009; Gilbert et al., 2000).

There exist notable disparities between commercial banks and participation banks with regards to their sources of finance and the methodology by which these monies are employed, thereby impacting their profitability and risk profiles. Thus, while assessing CAMELS criteria, ratios that are exclusively tailored to the distinct activities of participating banks are used. A comprehensive evaluation of the financial performance of participation banks in Turkey was conducted by considering key financial health indicators including capital sufficiency, asset quality, managerial efficiency, profitability, liquidity management, and susceptibility to market risk. By employing this methodology, a more comprehensive analysis has been conducted on the financial solidity and risk characteristics of these institutions.

MCDM techniques are a reliable framework for evaluating the financial performance of participation banks in Turkey. This approach is highly suitable for the present environment, as it allows including numerous qualitative and quantitative factors into evaluating. The mentioned MCDM approaches are effective in a variety of decision-making contexts and complexities, and, therefore, they are suitable for the financial performance analysis of participation banking as well (Yagli, 2020; Hamamcı and Karkacıer2022).

MCDM methodologies are widely used in the finance sector. These methodologies facilitate the resolution of complex and multifaceted issues such as banking, investment and portfolio management, portfolio optimization, credit assessment, financial performance evaluation of companies, investment evaluation, and financial risk management.

This study aims to evaluate the financial performance of participation banks in Turkey by employing Multiple Criteria Decision Making (MCDM) methodologies. A performance analysis relies on specific financial measures employed in the CAMEL system. Banking officials primarily utilize the latter as their preferred control and monitoring system. It is employed for the distant surveillance and oversight of financial institutions. We intend to conduct a comprehensive performance evaluation that takes into account many individual factors, including capital adequacy, asset quality, management effectiveness, earnings performance, liquidity position, and vulnerability to market risk. This examination will allow us to thoroughly and carefully evaluate the benefits and drawbacks of participation banks. This information is of utmost importance to both the administrators of this financial institution and its stakeholders, who include decision-makers, investors, and clients. An analysis was conducted on the financial performance of Albaraka Türk, Emlak Katılım, Kuveyt Türk, Türkiye Finans Katılım, Vakıf Katılım, and Ziraat Katılım, which are listed on the Borsa İstanbul exchange, using financial ratios as a proxy in 2021-2022-2023. The evaluation of the financial performance of participation banks in Turkey involves the calculation of the importance of financial ratios in order to determine the most crucial decision-making approach. The performance analysis of participation banks was conducted utilizing the TOPSIS, ARAS, and COPRAS methodologies.

The study consists of six parts. The next section is a literature review. The third part provides extensive details about the CAMELS system and an approach to the mode of critical decision-making, as well as the methodologies of TOPSIS, ARAS, and COPRAS. The fourth part describes the data collection process of the study and the variables used for it. The fifth section of the paper reports the study's results, and the last one provides an evaluation of the study's findings.

2. LITERATURE REVIEW

Several research are interested in using the CAMELS criterion to assess the performance of Islamic banks. This tool utilizes metrics such as capital adequacy, asset quality, management quality, earnings, liquidity, and susceptibility to market risk. In such a way, it can be assessed as a thorough apparatus to determine the financial soundness of any bank. With the help of such a strategy, it is possible to include other indicators and considerations apart from profit. It is important as the analysis of Islamic institutions is one of the most widespread objects under considerations for the past years (Dash, 2017).

Based on the information from the sources, one may conclude that research has suggested using of the CAMELS model to access and evaluate the financial performance of Islamic institutions. Examination of Islamic banks has many aspects, including asset quality, capital structure, profitability, efficiency, liquidity, and growth (Arif et al., 2018). Researchers have found that the CAMELS model is valuable in assessing the financial stability and health of Islamic banks, especially in light of major events such as the 2008 financial crisis (Danlami et al., 2022). n addition, the CAMELS technique was used to study the managerial and financial performance of Islamic banks in several countries, which suggests that this model is effective for assessing the overall health of the financial institutions (Erol et al., 2014). Thus, the CAMELS technique provides a structured tool for assessing the stability and efficiency of Islamic banks by investigating such aspects as capital adequacy, asset quality, and profitability (Muhammad & Triharyono, 2019).

Many research have been conducted on the measurement of bank performance by Multi-Criteria Decision-Making approaches. These studies facilitate the use of MCDM methodologies to evaluate the efficiency, productivity as well as the performance of a bank. Therefore, through the use of a hybrid MCDM approach integrating both the BSC and the MCDM approach, Yazdi et al. also assesses the effectiveness of Colombian banks (Yazdi et al., 2020). The purpose of this work is to assess the results of the activity of commercial banks in Turkey by applying an integrated Multiple Criteria Decision Making method. The key task of the current analysis is to measure the effect of the COVID-19 pandemic on the level of productivity of the given banks. Ünlü et al. (2022) and Beheshtinia and Omidi (2017) developed a hybrid Multiple Criteria Decision Making (MCDM) system for evaluating performance in the banking business. The methods take into account the social responsibility estimates in creating their decision making models. Application of Multiple Criteria Decision Making (MCDM) techniques, including WASPAS, has been suggested by Altinay et al. (2022) to enhance the assessment of financial performance in Islamic institutions. In their study, they employed these methodologies to assess the performance of participation banks in different nations, therefore offering a comprehensive study of the determinants that influence performance in diverse regulatory and economic contexts. This methodology enhances the CAMELS framework by integrating several performance indicators, therefore providing a more thorough evaluation of financial well-being. Beheshtinia and Omidi (2017) adopted a hybrid Multiple Criteria Decision Making system for rating performance in the banking trade. The methods take into account the social responsibility estimates in creating their decision making models. Create a multi-criteria decision-making model to evaluate and compare the performance of Turkish commercial banks by using the VIKOR technique, as proposed by İç et al. (2020) and Sama et al. (2020). Assess and prioritize Indian private sector banks utilizing Multiple Criteria Decision Making (MCDM) techniques, such as the TOPSIS method (Sama et al., 2020; Ghosh & Saima, 2021). This study aims to evaluate the ability of commercial banks in Bangladesh to withstand the impacts of the COVID-19 pandemic by employing MCDM-based approaches, specifically the TOPSIS method (Ghosh & Saima, 2021; Azad et al., 2022). Additionally, it seeks to reexamine the CAMELS rating system and the performance of ASEAN banks using a comprehensive MCDM/Z-Numbers approach (Azad et al., 2022; Abdulgader et al., 2018). Create a decision support model for choosing a maintenance plan by using a fuzzy Multiple Criteria Decision Making (MCDM) technique, as described by Abdulgader et al. (2018). Furthermore the SWARA method was employed by Terzioglu et al. (2022) to evaluate the financial performance of firms operating in the electricity, gas, and steam industries within the Borsa Istanbul. Their results revealed that asset turnover was the primary factor, and ENJSA achieved the top ranking in both WASPAS and VIKOR methodologies. In another study conducted by Terzioglu et al.

(2023) they studied the financial and environmental sustainability performance of nine public and private banks by employing the Moora, Ocra, and TIA methodologies. The study revealed that Vakıflar Bank of Turkey achieved the highest score based on the Moora and TIA methodologies, while Ziraat Bank of the Republic of Turkey secured the top position according to the Ocra method.

The TOPSIS technique is currently one of the most popular tools for rating and ranking banks by certain criteria. Multiple studies have been devoted to discussing the matter of assessing the performance of banks using TOPSIS and demonstrate its efficiency in banking. In particular, a study conducted by Al-Khulaidi (2024) and Yagli (2020) investigates information security risk management in Yemeni banks using a CILOS-TOPSIS methodology. The study ranks 13 banks in the area by several criteria and thus shows the best-performing banks in terms of information security risk management. The research by Yagli (2020) also uses the TOPSIS approach to study the financial performance of Turkish participation banks and analyses many parameters. In the study conducted by Unvan (2020), the author explains financial performance analysis of the banks with the help of TOPSIS and Fuzzy TOPSIS techniques. An important fact emerges that this technique is significant in the assessment of bank status. As for Chitnis & Vaidya (2018), the authors propose a methodology for the evaluation of efficiency with the help of Stochastic Frontier Analysis and TOPSIS. The significance of the provision of the poor operating services by the banking employees is discussed. It is a two-stage TOPSIS technique with stepwise regression. Sarı and Kayral (2019) suggested a reliable model to assess bank performance. These results are consistent with the conclusions of Coşkun, who assessed the financial performance of the companies included in the BIST Sustainability 25 Index using the TOPSIS method, emphasizing the significance of sustainability in financial evaluations (Coşkun, 2023). Moreover, the financial performance of the technology sector business listed in Istanbul stock exchange was evaluated using the TOPSIS technique by Bulut & Simsek (2022). The purpose was to check the relationship between the financial performance and the market capitalization. The results indicate the annual variation in the performance rankings of these organizations owing to national and worldwide reasons. Smilarly a CIRITIC-based TOPSIS approach was used to evaluate participation banks. The results showed that Vakıf Participation Bank had the best performance in 2018, demonstrating the effective use of Multiple Criteria Decision Making (MCDM) methods in the banking sector (Coşkuner, 2024). Additionally, the analysis points out that there is no continuous relationship between the change in the market value and the rankings for the firms obtained using the TOPSIS criterion. The TOPSIS method is applicable primarily based on the results presented in the studies (Abd Rahim et al., 2020; Bozdoğan et al., 2021). Abd Rahim et al. (2020) examines how this method is applied in assessing the financial performance of construction enterprises in Malaysia's construction industry, which demonstrates its relevance in many other realms. Additionally, Bozdoğan et al. (2021) conducts financial analysis of international banks in Turkey using the TOPSIS and ELECTRE methods to reveal appropriateness of the former in comparing performance.

The ARAS approach is used for multi-criteria decision-making in many domains as it effectively evaluates alternatives by numerous criteria. The particular ARAS technique is viewed as the systematic way to analyze the bank performance. It consists of many criteria considered all at once. Ecer (2017) conducted research that implemented a comprehensive model, which integrated the Fuzzy AHP with ARAS to evaluate the efficiency of mobile banking service. This applicative example proves the flexibility of ARAS in the resolution of complicated decision challenges in the solidness of the banking industry. The research conducted by Prasad (2019) rank Serbian banks based on their performance utilizing the ARAS method alongside other MCDM methods. According to Nanda et al. (2022) the ARAS technique refers to the assessment of alternatives by comparing their level of utility in the form of index values. This gives a systematic way through which decision-makers assign ranks to their alternatives. Additionally, Mishra et al. (2023) developed a Dual Probabilistic Linguistic Full Consistency Additive Ratio Assessment Model for supplier selection, showing the ARAS to be deployable in different decision analysis. Moreover, the ARAS approach has been coupled with the fuzzy logic and other Multiple Criteria Decision Making methods to improve its decision-making capability. Bos and Chatterjee (2016) combined Fuzzy ARAS with Fuzzy MOORA to select the wind turbine maintenance staff is a case of how the approach is deployable in different decision-making. And a research conducted by Yaşar and Terzioğlu (2022) assessed the financial performance of eight energy sector firms listed on the Borsa Istanbul using Entropy-based ARAS and GRI methods. The findings of the study indicated that Enerjisa presented the best performance.

The COPRAS approach which is also known as Complex Proportional Assessment as one of the proper methods which is a well-known method in the MCDM. In this methodology, utilizing a proper and well known method, all the options are assessed, and a decision is made. There is also a model called COPRAS, which is an organized method to analyze the performance of the bank by employing many criteria in a bank performance analysis context. Taherdoost in the year 2024.

The study by Maredza et al. (2021) shows the uniqueness of COPRAS in the particularization of partial utility functions of the single banking performance criterion, unlike other MCDM approaches. These differences prove that the chosen technique is the most effective for the approached study as well as the chosen concept for the examination and description of the banking performance criteria. At the same time, there are several recommendations about the use of the COPRAS method and its combination with other MCDM approaches for the improvement of its decision-making abilities in the banking industry. For example, in the study by Bekar et al. (2016) incorporated the fuzzy AHP method in the COPRAS-G concept for the evaluation of online branches' effectiveness in the banking sector. This study proves that this method is adaptable to the requirements of different banking assessment processes.

In general, the provided literature demonstated the utilization of the CAMELS framework and MCDM techniques, namely TOPSIS, ARAS, and COPRAS, for the scrutiny of the financial performance of Islamic and conventional banks. Both of these systems allow generating a comprehensive assessment as they are capable of integrating many various criteria for the examination of banking processes. The CAMELS assessment can be beneficial for the evaluation of financial soundness and stability, while MCDM methods can improve decision-making by the application of strong ranking and prioritization procedures. The utilization of these methods in various researches signifies their appropriateness for the provision of the most detailed investigation of banking performance and resistance to risks. In this way, it demonstrates their vital importance for financial inquiries of academic and pragmatic nature.

3. METHODOLOGY

In this study, we have taken the financial data of years 2021-2022-2023 of six participation banks traded in the Borsa Istanbul and using the multi-criteria decision-making methodologies to rate them on the financial performance. The financial statistics based on the CAMELS criteria have been considered for this study to assess and rate the performance of participation banks. The criteria of the study have been listed in Table 1.

Table 1. CAMELS Criteria

	Criteria	
C	Equity / Total Liabilities	X1
	Equity / Total Assets	X2
	(Equity - Fixed Assets) / Total Assets	X3
A	Non-Performing Loan Receivables / Total Loan Receivables	X4
	Non-Performing Loan Receivables / Total Receivables	X5
M	Personnel Expenses / Operating Expenses	X6
	Personnel Expenses / Total Expenses	X7
	Operating Expenses / Total Expenses	X8
E	Net Profit / Total Assets	X9
	Net Profit / Equity	X10
	Net Dividend Income / Total Assets	X11
	Profit Before Tax / Total Liabilities And Equity	X12
	Profit Per Share	X13
L	Total Loan Receivables / Total Assets	X14
	Liquid Assets / Total Assets	X15
	Liquid Assets / Short-Term Liabilities	X16
	Turkish Lira Liquid Assets / Total Assets	X17
S	Foreign Currency Assets / Total Assets	X18
	Total Funds Collected / Total Assets	X19
	Net Balance Sheet Position / Equity	X20

The information required for designing the decision matrix utilized in the research were acquired from the financial data disclosed by the relevant firms to the Public Disclosure Platform (KAP). The decision matrix, built based on the data acquired from KAP, is shown in Table 2.

Table 2. Decision Matrix

Criteria	ALBARAKA	EMLAK	KUVEYTTURK	TURKIYE FINANS	VAKIF	ZIRAAT
X1	0.0656	0.0589	0.0774	0.0898	0.1020	0.0544
X2	0.0615	0.0556	0.0718	0.0824	0.0926	0.0516
X3	0.0206	0.0493	0.0652	0.0554	0.0806	0.0442
X4	0.0175	0.0036	0.0140	0.0152	0.0303	0.0075

X5	0.0175	0.0017	0.0126	0.0142	0.0092	0.0062
X6	0.1999	0.2487	0.3332	0.3708	0.2573	0.2125
X7	0.0980	0.0787	0.1295	0.0979	0.0706	0.0435
X8	0.4234	0.2521	0.2487	0.2210	0.2215	0.1890
X9	0.0177	0.0274	0.0398	0.0243	0.0256	0.0104
X10	0.2874	0.4931	0.5545	0.2952	0.2765	0.2019
X11	0.0370	0.0335	0.0527	0.0314	0.0350	0.0141
X12	0.0250	0.0405	0.0501	0.0318	0.0325	0.0115
X13	1.3714	4.9951	5.7846	2.2480	0.0059	0.6351
X14	0.4486	0.3619	0.4463	0.4697	0.1834	0.6760
X15	0.2722	0.4478	0.2376	0.2185	0.1936	0.1917
X16	1.5187	2.3517	1.1563	0.8812	0.5698	0.7110
X17	0.1009	0.0929	0.0450	0.0735	0.0451	0.0633
X18	0.1713	0.3549	0.1927	0.1449	0.1485	0.1284
X19	0.6937	0.8071	0.7596	0.7366	0.8062	0.7921
X20	-0.9410	-0.2166	-0.4394	-0.2557	0.2239	0.0333

3.1. CRITIC Method

The CRITIC method allows the importance weights of the criteria to be calculated from the data without the need for expert opinion. This method was first introduced by Diakoulaki et al. (1995). In the CRITIC method, the standard deviation and correlation coefficient of each criterion are used to calculate the criteria (Ecer and Güneş, 2024). The CRITIC method has five stages. These stages are given below.

1. Stage: The Decision Matrix is constructed as follows. The representative decision matrix is shown in Equation 1.

$$\begin{bmatrix} x_{11} & \cdots & x_{1j} \\ \vdots & \ddots & \vdots \\ x_{i1} & \cdots & x_{ij} \end{bmatrix} \quad (1)$$

2. Stage: The Decision Matrix is normalized by converting the data into a standardized unit. Equation 2 is used to normalize the benefit criterion, whereas Equation 3 is used to normalize the cost criteria throughout the normalization process.

$$r_{ij} = \frac{x_{ij} - x_j^{min}}{x_j^{max} - x_j^{min}} \quad (2)$$

$$r_{ij} = \frac{x_j^{max} - x_{ij}}{x_j^{max} - x_j^{min}} \quad (3)$$

3. Stage: The correlation between the criterion is determined by calculating the Pearson correlation coefficient p_{jk} using Equation 4. This equation utilizes the normalized decision matrix and the value r_{ij}.

$$p_{jk} = \frac{\sum_{i=1}^{m}(r_{ij} - \overline{r_j})(r_{ik} - \overline{r_k})}{\sqrt{\sum_{i=1}^{m}(r_{ij} - r_j)^2 \sum_{i=1}^{m}(r_{ik} - r_k)^2}} \; j,k = 1,2,\ldots.n \quad (4)$$

4. Stage: The C_j values, which quantify the information content of each criteria, are computed by applying Equations 5 and 6 to the derived correlation coefficients. The symbol σ_j denotes the standard deviation of each column in the decision matrix.

$$\sigma_j = \sqrt{\frac{\sum_{i=1}^{m}(r_{ij} - \overline{r_j})^2}{m}} \quad (5)$$

$$C_j = \sigma_j \sum_{k=1}^{n} 1 - p_{jk} \quad (6)$$

5. Stage: The criteria weights are determined by computing the C_j values for each criterion and then using Equation 7 to obtain the weight values w_j.

$$w_j = \frac{C_j}{\sum_{k=1}^{n} C_k} \quad (7)$$

In this context, the criteria that has the greatest w_j value is regarded as the criterion with the utmost significance.

3.2. TOPSIS Method

TOPSIS approach was first proposed by Hwang and Yoon in the year 1981. The TOPSIS approach is widely used in the literature. An important reason behind this is the ability of the TOPSIS technique to timely and effectively decision making even when the data set is limited (Dewi et. al., 2020). There are six steps in the implementation of the TOPSIS approach. Firstly, a decision matrix is created. Therefore, the second step involves normalizing it, and the third step takes place once the decision matrix has been normalized. At this stage, a decision matrix is constructed by using the normalized matrix and incorporating the estimated weights for the related criteria. The fourth phase involves identifying the most favorable positive and negative solutions. This requires utilizing a matrix of solutions with assigned weights. In the fifth stage, the Euclidean distance of each alternative is calculated based on the positive and negative alternatives for performing the problem. The final stage involves assessing the proximity of the options, evaluating them, and ranking them to determine the best decision (Sakarya & Aksu, 2020). The formulas corresponding to the described stages of the TOPSIS approach are presented below as Equations 8-14.

$$r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^{m} a_{ij}^2}} \tag{8}$$

$$v_{ij} = w_j x r_{ij} \tag{9}$$

$$A^+ = \{(max v_{ij} \mid j \in J), (min v_{ij} \mid \in J')\} \tag{10}$$

$$A^- = \{(min v_{ij} \mid j \in J), (max v_{ij} \mid \in J')\} \tag{11}$$

$$S_i^+ = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^+\right)^2} \tag{12}$$

$$S_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^-\right)^2} \tag{13}$$

$$c_i^* = \frac{S_i^-}{S_i^+ + S_i^-} \tag{14}$$

3.3. ARAS Method

The ARAS approach is a decision-making technique that involves rating options based on their utility function values. The ARAS technique involves comparing the ratios of each option to the utility function of the best alternative in order to make a decision (Sliogeriene et al., 2013). Zavadskas and Turkis initially introduced the ARAS method in 2010. It is worth noting that the ARAS method is an effective analysis tool that helps decision-makers rank various alternatives as its implementation stages are simple, and the result of ranking alternatives is transparent (Sapkota, 2024). However, the most negative feature of the ARAS method is that it is limited to decision criteria focused only on value maximization. In situations where the criteria for making a decision contain other factors besides maximizing, for example, different occasions, this can have a certain effect on the decision-making process (Mishra, 2024). The ARAS approach has four sequential stages (Zavadskas & Turkis, 2010). In the first step, a decision matrix is built. The second phase is represented by the procedure of normalizing the decision matrix, and the third implied step is connected with the combination of the normalized decision matrix. In the last stage, it is essential to calculate the utility degrees "K_i" and order the alternatives. The utility degrees are received through dividing the value of the optimality function “S_i” by the optimal function value “S_0″ of each option in the wight normalized choice matrix. The equations for the ARAS approach are provided below as Equations 15-21.

$$r_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} \text{ (For Benefit Criteria)} \tag{15}$$

$$r_{ij} = \frac{\sum_{i=1}^{m} x_{ij}}{x_{ij}} \text{ (For Cost Criteria)} \tag{16}$$

$$z_{ij} = w_j x r_{ij} \tag{17}$$

$$z^* = [z_1^*. z_2^*. z_3^* \ldots \ldots z_n^*] \tag{18}$$

$$S_i = \sum_{j=1}^{n} z_{ij} \tag{19}$$

$$S^* = \sum_{j=1}^{n} z_j^* \tag{20}$$

$$K_i = \frac{S_i}{S_*} \tag{21}$$

3.4. COPRAS Method

The COPRAS approach was first presented by Zavadskas and Kaklauskas in 1996. The method is widely used in the literature because it is conveniently possible to choose among various criteria and alternatives (Sarıçalı & Kundakçı, 2016). The COPRAS method is also most convenient for users, with the ability to take various criteria ratios into account operations at the same time, assess alternatives in terms of their importance and superiority, and systematically evaluate each alternative similar to the AHP method (Matic et al., 2019; Wang et al., 2022; Pakšytė & Jurevičienė, 2022; Kushadianto & Ciptomulyono, 2022). COPRAS technique has seven sequential stages. Firstly, the decision matrix is established and then standardized. The third stage is the one where the decision matrix is normalized and then weighted through giving the degree of significance for the weapon selection criteria. In the fourth step, value of the criteria in the decision matrix is determined outlining the fact that the criteria provide benefit and cost. At the fifth level, the relative significance of each option is determined. Consequently, the option which holds the greatest relative relevance value is selected as the best option. In the seventh and the last stage, the performance index is calculated for each option. Thus, selection of the option with the performance index 1 which is the best option, and the remaining ones will be weighted in relation to that. The formulas for the COPRAS technique are provided in Equations 22-28.

$$x_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} \tag{22}$$

$$D' = d_{ij} = x_{ij}^{*} x w_j \tag{23}$$

$$S_{i+} = \sum_{j=1}^{k} d_{ij} \text{ (For Benefit Criteria)} \tag{24}$$

$$S_{i-} = \sum_{j=k+1}^{k} d_{ij} \text{(For Cost Criteria)} \tag{25}$$

$$Q_i = S_{i+} + \frac{\sum_{i=1}^{m} S_{i-}}{S_{i-} \sum_{i=1}^{m} \frac{1}{S_{i-}}} \tag{26}$$

$$Q_{max} = en\ büyük\{Q_i\} \tag{27}$$

$$P_i = \frac{Q_i}{Q_{max}} \tag{28}$$

4. FINDINGS

This research utilizes financial data from participation banks that are traded on Borsa Istanbul. The data were acquired via the use of the financial balance sheets given by the firms on the Public Disclosure Platform. The study's criterion weights were determined using the CRITIC approach. Subsequently, the CRITIC approach was used to determine the weights of the criterion. These weights were then utilized to rank participation banks using the TOPSIS, WASPAS, and COPRAS procedures.

Within the application portion, the first step included assigning weights to the criteria that will be used in the research. The CRITIC approach was used to assign weights to the criterion. During the first phase, the decision matrix underwent normalization. The choice matrix was normalized using the min-max normalization approach. The choice matrix has been normalized and is shown in Table 3.

Table 3. Normalized Decision Matrix

	ALBARAKA	EMLAK	KUVEYTTURK	TURKIYE FINANS	VAKIF	ZIRAAT
X1	0.409	0.053	0.083	0.138	0.120	0.061
X2	0.408	0.052	0.082	0.135	0.108	0.058
X3	0.391	0.051	0.081	0.124	0.093	0.048
X4	0.610	0.958	0.927	0.892	0.970	0.998
X5	0.610	0.958	0.927	0.892	0.996	1.000
X6	0.536	0.911	0.876	0.750	0.686	0.738
X7	0.578	0.943	0.909	0.859	0.919	0.953
X8	0.445	0.910	0.889	0.810	0.731	0.767
X9	0.390	0.047	0.077	0.112	0.025	0.005
X10	0.499	0.136	0.160	0.220	0.338	0.249
X11	0.398	0.048	0.079	0.115	0.036	0.010
X12	0.393	0.049	0.079	0.115	0.033	0.007

X13	0.940	1.000	1.000	1.000	0.000	0.800
X14	0.435	0.889	0.858	0.710	0.778	0.148
X15	0.493	0.127	0.109	0.189	0.235	0.236
X16	1.000	0.493	0.256	0.454	0.705	0.897
X17	0.424	0.059	0.078	0.131	0.049	0.073
X18	0.452	0.110	0.102	0.160	0.178	0.156
X19	0.335	0.804	0.807	0.604	0.000	0.000
X20	0.000	0.000	0.000	0.000	0.272	0.035

After normalizing the decision matrix, the correlation matrix of the criteria was calculated using Equation 4. The correlation matrix is shown in Table 4.

Table 4. Correlation Matrix

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20
X1	1.000	1.000	0.998	-0.976	-0.961	-0.843	-0.992	-0.933	0.970	0.891	0.976	0.973	0.093	-0.275	0.927	0.582	0.976	0.978	-0.150	-0.128
X2	1.000	1.000	0.999	-0.982	-0.969	-0.830	-0.995	-0.926	0.977	0.878	0.982	0.980	0.123	-0.275	0.922	0.572	0.982	0.976	-0.127	-0.158
X3	0.998	0.999	1.000	-0.988	-0.977	-0.809	-0.998	-0.914	0.984	0.862	0.988	0.986	0.153	-0.260	0.911	0.553	0.986	0.971	-0.094	-0.186
X4	-0.976	-0.982	-0.988	1.000	0.998	0.712	0.995	0.844	-1.000	-0.773	-1.000	-1.000	-0.288	0.194	-0.849	-0.454	-0.987	-0.930	-0.055	0.315
X5	-0.961	-0.969	-0.977	0.998	1.000	0.679	0.988	0.819	-0.999	-0.737	-0.998	-0.998	-0.353	0.204	-0.828	-0.433	-0.987	-0.914	-0.096	0.380
X6	-0.843	-0.830	-0.809	0.712	0.679	1.000	0.779	0.961	-0.698	-0.974	-0.715	-0.706	0.294	0.554	-0.941	-0.813	-0.767	-0.893	0.638	-0.239
X7	-0.992	-0.995	-0.998	0.995	0.988	0.779	1.000	0.890	-0.993	-0.829	-0.995	-0.994	-0.216	0.252	-0.891	-0.519	-0.991	-0.958	0.041	0.248
X8	-0.933	-0.926	-0.914	0.844	0.819	0.961	0.890	1.000	-0.833	-0.984	-0.846	-0.839	0.136	0.517	-0.994	-0.813	-0.889	-0.977	0.488	-0.080
X9	0.970	0.977	0.984	-1.000	-0.999	-0.698	-0.993	-0.833	1.000	0.758	1.000	1.000	0.315	-0.196	0.840	0.444	0.987	0.924	0.074	-0.342
X10	0.891	0.878	0.862	-0.773	-0.737	-0.974	-0.829	-0.984	0.758	1.000	0.774	0.766	-0.307	-0.454	0.963	0.801	0.810	0.937	-0.570	0.255
X11	0.976	0.982	0.988	-1.000	-0.998	-0.715	-0.995	-0.846	1.000	0.774	1.000	1.000	0.289	-0.201	0.851	0.459	0.988	0.932	0.051	-0.317
X12	0.973	0.980	0.986	-1.000	-0.998	-0.706	-0.994	-0.839	1.000	0.766	1.000	1.000	0.298	-0.191	0.844	0.448	0.987	0.927	0.065	-0.325
X13	0.093	0.123	0.153	-0.288	-0.353	0.294	-0.216	0.136	0.315	-0.307	0.289	0.298	1.000	-0.057	-0.071	-0.259	0.289	0.026	0.702	-0.996
X14	-0.275	-0.275	-0.260	0.194	0.204	0.554	0.252	0.517	-0.196	-0.454	-0.201	-0.191	-0.057	1.000	-0.554	-0.791	-0.345	-0.422	0.668	0.138
X15	0.927	0.922	0.911	-0.849	-0.828	-0.941	-0.891	-0.994	0.840	0.963	0.851	0.844	-0.071	-0.554	1.000	0.842	0.902	0.982	-0.467	0.013
X16	0.582	0.572	0.553	-0.454	-0.433	-0.813	-0.519	-0.813	0.444	0.801	0.459	0.448	-0.259	-0.791	0.842	1.000	0.568	0.735	-0.767	0.182
X17	0.976	0.982	0.986	-0.987	-0.987	-0.767	-0.991	-0.889	0.987	0.810	0.988	0.987	0.289	-0.345	0.902	0.568	1.000	0.959	-0.052	-0.328
X18	0.978	0.976	0.971	-0.930	-0.914	-0.893	-0.958	-0.977	0.924	0.937	0.932	0.927	0.026	-0.422	0.982	0.735	0.959	1.000	-0.303	-0.074
X19	-0.150	-0.127	-0.094	-0.055	-0.096	0.638	0.041	0.488	0.074	-0.570	0.051	0.065	0.702	0.668	-0.467	-0.767	-0.052	-0.303	1.000	-0.642
X20	-0.128	-0.158	-0.186	0.315	0.380	-0.239	0.248	-0.080	-0.342	0.255	-0.317	-0.325	-0.996	0.138	0.013	0.182	-0.328	-0.074	-0.642	1.000

Equations 5 and 6 were used to determine the standard deviation values (σ_j) of each criterion and the C_j values, which measure the quantity of information of the criteria, after the correlation matrix was produced. Subsequently, Equation 7 was used to assign weights to each criteria based on the CRITIC approach. Table 5 displays the standard deviations of the criteria, the quantity of information, and the weight values acquired from this data.

Table 5. Weight Values of Criteria According To CRITIC Method

Criteria	Std. Deviation	C_j	W_j
X1	0.1340	1.9960	0.0299
X2	0.1345	2.0000	0.0299
X3	0.1302	1.9317	0.0289
X4	0.1430	3.6066	0.0540
X5	0.1465	3.6881	0.0552
X6	0.1354	3.1965	0.0478
X7	0.1422	3.5807	0.0536
X8	0.1683	4.1027	0.0614
X9	0.1425	2.1081	0.0315
X10	0.1343	2.1403	0.0320
X11	0.1434	2.1200	0.0317

X12	0.1422	2.1019	0.0314
X13	0.3947	7.4323	0.1112
X14	0.2890	5.9241	0.0886
X15	0.1387	2.1635	0.0324
X16	0.2839	5.0136	0.0750
X17	0.1439	2.1464	0.0321
X18	0.1306	1.9746	0.0295
X19	0.3717	7.2839	0.1090
X20	0.1093	2.3258	0.0348

After the weights of the criteria is determined, the alternatives were ranked using the TOPSIS, ARAS, and COPRAS techniques after establishing the weight values of the criteria in the research.

4.1. TOPSIS Results

The research first rated the alternatives based on the TOPSIS approach. The ranking process using the TOPSIS approach used criterion weights generated from the CRITIC method. The decision matrix was first normalized in the TOPSIS approach. Equation 8 was used to normalize the choice matrix. The choice matrix that has been standardized is shown in Table 6.

Table 6. TOPSIS Method Normalized Decision Matrix

	ALBARAKA	EMLAK	KUVEYTTURK	TURKIYE FINANS	VAKIF	ZIRAAT
X1	0.02634	0.01039	0.01282	0.03385	0.08794	0.03683
X2	0.02472	0.00982	0.01190	0.03106	0.07980	0.03492
X3	0.00829	0.00871	0.01080	0.02090	0.06948	0.02989
X4	0.00703	0.00063	0.00232	0.00573	0.02612	0.00505
X5	0.00702	0.00030	0.00208	0.00536	0.00790	0.00420
X6	0.08031	0.04393	0.05524	0.13977	0.22175	0.14379
X7	0.03939	0.01391	0.02146	0.03690	0.06087	0.02944
X8	0.17015	0.04453	0.04122	0.08331	0.19088	0.12789
X9	0.00710	0.00484	0.00660	0.00917	0.02206	0.00705
X10	0.11549	0.08711	0.09193	0.11128	0.23834	0.13665
X11	0.01488	0.00591	0.00872	0.01183	0.03016	0.00956
X12	0.01005	0.00715	0.00831	0.01199	0.02805	0.00778
X13	0.55115	0.88256	0.95900	0.84744	0.00509	0.42982
X14	0.18026	0.06394	0.07398	0.17705	0.15803	0.45752
X15	0.10941	0.07911	0.03939	0.08236	0.16688	0.12973
X16	0.61033	0.41551	0.19170	0.33217	0.49110	0.48116
X17	0.04055	0.01641	0.00745	0.02772	0.03889	0.04281
X18	0.06885	0.06270	0.03194	0.05464	0.12798	0.08691
X19	0.27878	0.14260	0.12592	0.27769	0.69486	0.53608
X20	-0.3781	-0.03827	-0.07285	-0.09638	0.19299	0.02257

Once the decision matrix has been normalized, the weighted normalized decision matrix V_(ij) is created by applying the weights of the criterion acquired using the CRITIC approach as per Equation 9. The Table 7 displays the weighted normalized decision matrix.

Table 7. TOPSIS Method Weighted Normalized Decision Matrix

	ALBARAKA	EMLAK	KUVEYTTURK	TURKIYE FINANS	VAKIF	ZIRAAT
X1	0.00078	0.000311	0.000383	0.001011	0.002627	0.0011
X2	0.00074	0.000294	0.000356	0.00093	0.002388	0.001045
X3	0.00024	0.000252	0.000312	0.000604	0.002008	0.000864
X4	0.000379	3.41E-05	0.000125	0.00031	0.00141	0.000273
X5	0.000388	1.7E-05	0.000115	0.000296	0.000436	0.000232
X6	0.003841	0.002101	0.002642	0.006685	0.010606	0.006877
X7	0.002111	0.000745	0.00115	0.001977	0.003261	0.001577
X8	0.010445	0.002734	0.002531	0.005114	0.011717	0.007851
X9	0.000224	0.000153	0.000208	0.000289	0.000696	0.000222
X10	0.003698	0.00279	0.002944	0.003564	0.007632	0.004376
X11	0.000472	0.000188	0.000277	0.000376	0.000957	0.000303
X12	0.000316	0.000225	0.000261	0.000377	0.000882	0.000245
X13	0.061288	0.098141	0.106642	0.094236	0.000566	0.047797
X14	0.015978	0.005668	0.006558	0.015693	0.014008	0.040553
X15	0.003542	0.002561	0.001275	0.002666	0.005402	0.004199
X16	0.045783	0.031169	0.01438	0.024917	0.036839	0.036093
X17	0.001302	0.000527	0.00024	0.00089	0.001249	0.001375
X18	0.002034	0.001853	0.000944	0.001614	0.003781	0.002568
X19	0.030382	0.015541	0.013723	0.030263	0.075726	0.058422
X20	-0.01316	-0.00133	-0.00253	-0.00335	0.006716	0.000785

Once the weighted normalized choice matrix was obtained, the positive and negative ideal solutions were identified using Equations 10 and 11. Subsequently, the distances of each option to the positive and negative ideal solution were computed using Equations 12 and 13. Ultimately, the TOPSIS scores for each option were calculated using Equation 14, and the alternatives were then rated. The results of the ranking achieved using the TOPSIS approach are shown in Table 8.

Table 8. Ranking of Alternatives According To TOPSIS Method

Alternatives	S_i+	S_i-	C_j^*	Ranking
ALBARAKA	0.05418125	0.085976013	0.613425313	4
EMLAK	0.020101706	0.122253262	0.858791681	1
KUVEYT TURK	0.033681598	0.128526585	0.792355743	2
TÜRKİYE FİNANS	0.033623593	0.108316816	0.763114723	3
VAKIF	0.124141519	0.040839058	0.247538582	6
ZİRAAT	0.082938507	0.056970432	0.407196512	5

Upon analyzing the findings produced using the TOPSIS approach and considering the CAMELS criteria of the alternatives, it is concluded that EMLAK Katılım is the optimal choice. Subsequently, it is noted that Kuveyttürk is the second most favorable option. Subsequently, Türkiye Finans, Albaraka, Ziraat Katilim, and Vakıf Katilim are mentioned in that order.

4.2. ARAS Results

The research included ranking the criteria weighted using the CRITIC technique using the ARAS method as well. To achieve this objective, the decision matrix was first formulated, and then, the decision matrix was generated, whereby the optimal values were identified. The optimal value was calculated as the greatest value among the options for the benefit criteria and the lowest value among the alternatives for the cost criteria. The choice matrix, which presents the optimal values, is shown in Table 9.

Table 9. Decision Matrix Determining Optimum Values

	X1	X2	X3	X4	….	….	X17	X18	X19	X20
WEIGHTS	0.0298	0.0299	0.028902	0.0539	….	…..	0.0321	0.0295	0.108	0.0347
BENEFIT/COST	+	+	+	-	….	…..	+	+	-	+
OPTIMUM	0.1020	0.0926	0.0806	0.0035	….	…..	0.1009	0.3549	0.6937	0.2239
ALBARAKA	0.0656	0.0615	0.0206	0.0175	….	…..	0.1009	0.1713	0.6937	-0.9410
EMLAK	0.0589	0.0556	0.0493	0.0036	….	…..	0.0929	0.3549	0.8071	-0.2166
KUVEYT TURK	0.0774	0.0718	0.0652	0.0140	….	…..	0.0450	0.1927	0.7596	-0.4394
TÜRKİYE FİNANS	0.0898	0.0824	0.0554	0.0152	….	…..	0.0735	0.1449	0.7366	-0.2557
VAKIF	0.1020	0.0926	0.0806	0.0303	….	…..	0.0451	0.1485	0.8062	0.2239
ZİRAAT	0.0544	0.0516	0.0442	0.0075	….	…..	0.0633	0.1284	0.7921	0.0333

Following the decision matrix, where the optimal values were identified, the modified decision matrix was acquired. In this case, the benefit-side criterion values are used as they are, while the cost-side criteria values are derived using the formula $x_{ij} = \frac{1}{x_{ij}^*}$. The matrix is shown in Table 10.

Table 10. Benefit Transformed Decision Matrix

	X1	X2	X3	X4	….	….	X17	X18	X19	X20
WEIGHTS	0.0299	0.0299	0.0289	0.0540	…	…	0.0321	0.0295	0.1090	0.0348
OPTIMUM	0.1020	0.0926	0.0806	279.67	…	…	0.1009	0.3549	1.4416	0.2239
ALBARAKA	0.0656	0.0615	0.0206	57.152	…	…	0.1009	0.1713	1.4416	-0.9410
EMLAK	0.0589	0.0556	0.0493	279.67	…	…	0.0929	0.3549	1.2390	-0.2166
KUVEYT TURK	0.0774	0.0718	0.0652	71.334	…	…	0.0450	0.1927	1.3166	-0.4394
TÜRKİYE FİNANS	0.0898	0.0824	0.0554	65.685	…	…	0.0735	0.1449	1.3575	-0.2557
VAKIF	0.1020	0.0926	0.0806	32.989	…	…	0.0451	0.1485	1.2404	0.2239
ZİRAAT	0.0544	0.0516	0.0442	133.83	…	…	0.0633	0.1284	1.2625	0.0333
Sum of Column	0.5501	0.5081	0.3960	920.33	…	…	0.5217	1.4956	9.2991	-1.3715

Once the benefit-transformed decision matrix was obtained, it was normalized using Equations 15 and 16. The decision matrix that has been normalized is shown in Table 11.

Table 11. Normalized Decision Matrix

	X1	X2	X3	X4	….	….	X17	X18	X19	X20
WEIGHTS	0.0299	0.0299	0.0289	0.0540	…	…	0.0321	0.0295	0.1090	0.0348
OPTIMUM	0.1855	0.1822	0.2036	0.3039	…	…	0.1934	0.2373	0.1550	-0.1633
ALBARAKA	0.1192	0.1211	0.0521	0.0621	…	…	0.1934	0.1146	0.1550	0.6861
EMLAK	0.1070	0.1094	0.1246	0.3039	…	…	0.1781	0.2373	0.1332	0.1580
KUVEYT TURK	0.1407	0.1413	0.1645	0.0775	…	…	0.0862	0.1288	0.1416	0.3204
TÜRKİYE FİNANS	0.1633	0.1622	0.1400	0.0714	…	…	0.1410	0.0969	0.1460	0.1864
VAKIF	0.1855	0.1822	0.2036	0.0358	…	…	0.0865	0.0993	0.1334	-0.1633
ZİRAAT	0.0989	0.1016	0.1115	0.1454	…	…	0.1213	0.0859	0.1358	-0.0243

Once the decision matrix was normalized, it was further weighted using Equation 17. The resultant weighted normalized decision matrix may be seen in Table 12.

Table 12. Weighted Normalized Decision Matrix

	X1	X2	X3	X4	….	….	X17	X18	X19	X20
WEIGHTS	0.0299	0.0299	0.0289	0.0540	…	…	0.0321	0.0295	0.1090	0.0348
OPTIMUM	0.0055	0.0055	0.0059	0.0164	…	…	0.0062	0.0070	0.0169	-0.0057
ALBARAKA	0.0036	0.0036	0.0015	0.0034	…	…	0.0062	0.0034	0.0169	0.0239
EMLAK	0.0032	0.0033	0.0036	0.0164	…	…	0.0057	0.0070	0.0145	0.0055
KUVEYT TURK	0.0042	0.0042	0.0048	0.0042	…	…	0.0028	0.0038	0.0154	0.0111
TÜRKİYE FİNANS	0.0049	0.0049	0.0040	0.0039	…	…	0.0045	0.0029	0.0159	0.0065
VAKIF	0.0055	0.0055	0.0059	0.0019	…	…	0.0028	0.0029	0.0145	-0.0057
ZİRAAT	0.0030	0.0030	0.0032	0.0078	…	…	0.0039	0.0025	0.0148	-0.0008

Once the decision matrix has been normalized and weighted, the next step involves using Equation 19, 20, and 21 to rank the options. This is done by establishing the optimality function and the degree of utility for each alternative. Table 13 displays the ARAS scores and rankings of the options.

Table 13. Ranking of Alternatives According To ARAS Method

Alternatives	S_i	K_i	Ranking
ALBARAKA	0.1300964	0.6079766	3
EMLAK	0.1839962	0.8598651	1
KUVEYT TURK	0.1500565	0.7012557	2
TÜRKİYE FİNANS	0.1158962	0.5416149	4
VAKIF	0.1065222	0.4978076	5
ZİRAAT	0.09945	0.4647575	6
Z_j^*=0.21398			

Upon analyzing the findings of the alternatives generated using the ARAS approach and considering the CAMELS criterion, it is concluded that the optimal choice is EMLAK Katılım. Subsequently, it is noted that Kuveyttürk is the second most favorable option. Subsequently, Albaraka, Türkiye Finans, Vakıf Katilim, and Ziraat Katilim are mentioned in that order.

4.2. COPRAS Results

Eventually, the COPRAS approach was used to assess the alternatives, using the criterion weights acquired from the CRITIC method. In the COPRAS method, the decision matrix was first normalized using Equation 22. The resulting normalized decision matrix can be seen in Table 14.

Table 14. Normalized Decision Matrix

	X1	X2	X3	X4	….	….	X17	X18	X19	X20
BENEFIT/COST	+	+	+	-	…	…	+	+	-	+
WEIGHTS	0.02986	0.02992	0.02890	0.05396	…	…	0.03211	0.02954	0.10898	0.03480
ALBARAKA	0.14630	0.14805	0.06547	0.19860	…	…	0.23985	0.15019	0.15096	0.58981
EMLAK	0.13136	0.13376	0.15643	0.04059	…	…	0.22081	0.31110	0.17563	0.13578
KUVEYT TURK	0.17269	0.17283	0.20660	0.15912	…	…	0.10692	0.16889	0.16529	0.27542
TÜRKİYE FİNANS	0.20045	0.19833	0.17581	0.17280	…	…	0.17480	0.12706	0.16030	0.16025
VAKIF	0.22774	0.22283	0.25562	0.34408	…	…	0.10725	0.13017	0.17544	-0.1403
ZİRAAT	0.12146	0.12420	0.14006	0.08481	…	…	0.15036	0.11258	0.17237	-0.0209

Once the decision matrix was normalized, each criteria was assigned a weight using Equation 23, which used the weight values acquired from the CRITIC technique and shown in Table 15.

Table 15. Weighted Normalized Decision Matrix

	X1	X2	X3	X4	….	….	X17	X18	X19	X20
BENEFIT/COST	+	+	+	-	…	…	+	+	-	+
WEIGHTS	0.02986	0.02992	0.02890	0.05396	…	…	0.03211	0.02954	0.10898	0.03480

ALBARAKA	0.00437	0.00443	0.00189	0.01072	…	…	0.00770	0.00444	0.01645	0.02052
EMLAK	0.00392	0.00400	0.00452	0.00219	…	…	0.00709	0.00919	0.01914	0.00472
KUVEYT TURK	0.00516	0.00517	0.00597	0.00859	…	…	0.00343	0.00499	0.01801	0.00958
TÜRKİYE FİNANS	0.00599	0.00593	0.00508	0.00932	…	…	0.00561	0.00375	0.01747	0.00558
VAKIF	0.00680	0.00667	0.00739	0.01857	…	…	0.00344	0.00385	0.01912	-0.0048
ZİRAAT	0.00363	0.00372	0.00405	0.00458	…	…	0.00483	0.00333	0.01879	-0.0007

Following the calculation of the normalized decision matrix, the maximizing and minimizing index values were determined using Equations 24, 25, 26, 27, and 28. The alternatives were then ordered based on the relative weights assigned to each option. The order of the possibilities is shown in Table 16.

Table 16. Ranking of Alternatives According To COPRAS Method

Alternatives	S_{i+}	S_{i-}	Q_i	P_i	Ranking
ALBARAKA	0.0912	0.0910	0.1572	0.7021	3
EMLAK	0.1250	0.0607	0.2239	1.0000	1
KUVEYT TURK	0.1216	0.0862	0.1913	0.8541	2
TÜRKİYE FİNANS	0.0771	0.0854	0.1474	0.6582	4
VAKIF	0.0464	0.0758	0.1256	0.5611	6
ZİRAAT	0.0403	0.0703	0.1257	0.5613	5

Upon analyzing the findings of the alternatives generated using the COPRAS approach and considering the CAMELS criterion, it has been found that the most optimal alternative is EMLAK Katılım. Subsequently, it is noted that Kuveyttürk is the second most favorable option. Subsequently, Albaraka, Türkiye Finans, Ziraat Katilim, and Vakıf Katilim are mentioned in that order.

5. RESULTS AND DISCUSSION

The Turkish banking sector has experienced substantial transformations, with participation banks emerging as a prominent entity. These banks provide a different banking approach that emphasizes profit and loss sharing, ethical investments, and risk-sharing agreements. In this research, we used the CAMELS criteria, which were weighted using the CRITIC approach. Subsequently, the options were rated using three distinct MCDM procedures. The outcomes derived from the ranking process using TOPSIS, ARAS, and COPRAS techniques are shown in Table 17.

Table 17. Ranking Results of TOPSIS, ARAS and COPRAS Method

Alternatives	2021 TOPSIS	2021 ARAS	2021 COPRAS	2022 TOPSIS	2022 ARAS	2022 COPRAS	2023 TOPSIS	2023 ARAS	2023 COPRAS
EMLAK	6	6	6	3	2	3	1	1	1
KUVEYT TURK	3	1	2	4	4	4	2	2	2
TÜRKİYE FİNANS	1	2	1	2	3	2	3	4	4
ALBARAKA	4	5	4	1	1	1	4	3	3
ZİRAAT	2	3	3	5	6	6	5	6	5
VAKIF	5	4	5	6	5	5	6	5	6

Table 17 shows that bank performances for the years 2021, 2022 and 2023 were ranked using three different multi-criteria decision-making techniques (TOPSIS, ARAS, COPRAS). The data obtained during these three years reveal that there are certain trends and consistencies among the banks. When the three-year data is examined, it is seen that the performances of Emlak Katılım and Kuveyt Türk banks have improved significantly. Emlak Katılım rose to the first place in all methods in 2023 and proved itself as the best alternative. Kuveyt Türk, on the other hand, has shown consistent success by being in the first two places for three years. On the other hand, Türkiye Finans and Albaraka banks were generally ranked high, but experienced some fluctuations in their rankings in 2022 and 2023. Albaraka, in particular, reached the top in 2022, but fell slightly in 2023. Ziraat and Vakıf banks, on the other hand, were ranked low for three years and could not improve their performance. This situation indicates that these banks need to be reviewed strategically. These results, using three different methods, provide an opportunity to evaluate the performance of banks from a broader perspective, while the consistency of the results increases the reliability of the findings. In addition, using different methods provides an opportunity to examine the strengths and weaknesses of banks from different perspectives. Strategic interventions are required to improve the low performance of Ziraat and Vakıf banks in particular. Successful banks such as Emlak Katılım and Kuveyt Türk should continue their current strategies and invest in innovation and customer-oriented services in order to maintain this success and increase their competitive advantage. In general, the multi-criteria decision-making techniques used in this study provide a broader perspective in performance evaluations in the banking sector and bring a scientific perspective to decision-making processes.

Upon reviewing the literature, it is evident that ranking is often conducted using a singular approach (İç et al., 2020; Ghosh & Saima, 2021; Azad et al., 2022; Al-Khulaidi, 2024; Yagli, 2020; Bulut & Simsek, 2022; Abd Rahim et al., 2020). This research employs many methods to provide decision makers a thorough review opportunity. Furthermore, other research (Bulut & Simsek, 2022; Zavadskas et al., 2017; Haddad et al., 2018; Zubiria et al., 2022) have used expert opinion or equal weighting as ways of assigning weights. These methods are often favored due to their utilization of decision makers' experience, ability to consider intricate and subjective elements, and capacity for swift application. Nevertheless, the primary drawback of subjective techniques is their entire reliance on the personal experiences of decision makers, which might introduce biases that may compromise the objectivity of the decision-making process and give rise to uncertainties. Currently, in our research, to mitigate these risks, we used the CRITIC technique to assign weights to the criterion. The CRITIC approach is recognized as one of the unbiased ways for assigning weights. When considering the criteria, a scientific approach was used to choose an objective and consistent weighing system, rather than relying on human judgements.

In future research, the scope of the study may be broadened by including other criteria alongside the CAMELS criteria used in this study. Furthermore, this research used TOPSIS, ARAS, and COPRAS techniques to prioritize the different options. Unlike these methodologies, options may be evaluated using different multi-criteria decision-making techniques and contrasted with this research. Ultimately, this research aimed to compare the performances of 6 Participation Banks in the BIST index. In future research, one may study and compare the performances of organizations from other sectors with those of the financial industry.

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