*Demir Palancı, Z. & Yalçın, S. (2025). Analysing the financial performance of the companies in the borsa istanbul (bist) information technology index with the mabac method. Gümüşhane Üniversitesi Sosyal Bilimler Dergisi, 16(1), 327-341.*

# Analysing The Financial Performance Of The Companies In The Borsa Istanbul (BIST) Information Technology Index With The MABAC Method[1]

## Borsa İstanbul (Bist) Bilişim Endeksinde Yer Alan Şirketlerin Finansal Performansının MABAC Yöntemi İle Analizi

**Zuhal Demir Palancı[2], Selçuk Yalçın[3]**

### Abstract

*The IT sector plays an important role in the development and competitiveness of national economies and companies. For this reason, well analysing the performance of the IT sector, well identifying its shortcomings and weaknesses, and increasing the financial performance of the sector is also the key to increasing the performance of the country's economy. This study aims to evaluate the financial performance of IT sector companies registered at Borsa Istanbul between 2019 and 2023. For this purpose, 12 financial ratios obtained from the data of IT companies registered in BIST were identified as criteria. After weighting these criteria using the Entropy method, the performance of the companies was analysed using the MABAC method. As a result of the analysis, the company with the highest financial performance was Link Bilgisayar Sistemleri Yazılımı ve Donanımı Sanayi ve Ticaret A.Ş. (LINK), which was ranked first twice and second three times in the five years under review, while the companies with the worst financial performance have changed over the years.*

***Keywords:*** *Financial Performance, Multi-Criteria Decision Making,MABAC, IT Sector.*

### Öz

*Ülke ekonomilerinin ve işletmelerin kalkınmasında ve rekabet gücü elde edebilmesinde bilişim sektörü önemli bir rol oynamaktadır. Bu nedenle bilişim sektörünün performansının iyi analiz edilmesi, eksik ve zayıf yönlerinin iyi belirlenip sektörün finansal performansının yükseltilmesi aynı zamanda ülke ekonomisinin de performansının yükselmesinin anahtarı konumundadır. Bu çalışmada 2019-2023 yılları arasında Borsa İstanbul'a kayıtlı bilişim sektörü şirketlerinin finansal performansının değerlendirilmesi amaçlanmıştır. Bu amaç doğrultusunda BİST'e kayıtlı bilişim şirketlerinin verilerinden elde edilen 12 finansal oran kriter olarak belirlenmiştir. Belirlenen bu kriterler Entropi yöntemiyle ağırlıklandırıldıktan sonra MABAC yöntemiyle şirketlerin performans analizi yapılmıştır. Yapılan analiz sonucunda en yüksek finansal performansa sahip şirket inceleme yapılan 5 yıl süresince iki kez ilk sırayı ve 3 kez ikinci sırayı alan Link Bilgisayar Sistemleri Yazılımı ve Donanımı Sanayi ve Ticaret A.Ş. (LINK) olurken en kötü finansal performansa sahip şirketlerin yıllar itibariyle değişşiklik gösterdiği görülmüştür.*

***Anahtar kelimeler:*** *Finansal Performans, Çok Kriterli Karar Verme, MABAC, Bilişim Sektörü.*

**JEL Codes:** *G30, L25, P47.*

**Araştırma Makalesi [Research Paper]**

**Submitted:** 07 / 10 / 2024
**Accepted:** 16 / 01 / 2025

[1]Bu çalışma, Borsa İstanbul (BIST) Bilişim Endeksinde Yer Alan Şirketlerin Finansal Performansının MABAC Yöntemi ile Analizi başlıklı yüksek lisans tezinden türetilmiştir.

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## Intruduction

The world has undergone a major transformation with the transition from an industrial to an information society. The main component of this transformation is the dizzying rapid development in the information sector. Developments in the information sector, network technologies and the transformation of computers in recent years have undergone an unimaginable development and transformation compared to the years when computers started to emerge. This dizzying change in the informatics sector has caused very serious change and transformation in many different sectors such as education, health, production, tourism and industry, and even in all areas of public and social life.

This incredible development in the information sector penetrates every point of business life, affecting different sectors and transforming the businesses operating in these fields. This transformation also facilitates the activities of enterprises, while at the same time providing enterprises with the opportunity to compete nationally and internationally.

Countries that are able to integrate this change and transformation in the information system into their business life and use the opportunities offered by this transformation, especially in the competitive environment that has increased with the effect of globalisation, have provided them with significant advantages and enabled the information sector to constitute the main competitive power of the country's economies. This situation has caused the development of the IT sector to assume a decisive role in the development of national economies. The fact that the IT sector plays such an important role in the development of national economies has increased the importance of this sector and the performance of enterprises in this sector. Therefore, the good performance of the enterprises in this sector directly affects the development of both the sector and the national economies.

In order for businesses to perform well, they need to use their resources correctly and effectively and determine their investment and financing plans for the future in a realistic manner. Businesses that can achieve this have the advantage to compete by moving their performance upwards. The concept of performance can also be expressed as the level of achievement of the objectives of the enterprises. Therefore, enterprises show a successful performance to the extent that they can achieve their goals. For this reason, performance measurement at certain intervals is essential for businesses. In other words, performance measurement is an extremely important point for businesses in order to maintain the success of an enterprise and to ensure the continuity of this success (Karaman, 2009). To the extent that enterprises can make this measurement accurately and effectively, they can see their real performance and make plans for the future accordingly.

The use of financial data obtained from the balance sheets of enterprises in performance measurement is a frequently used approach in the literature. In this direction, these data obtained from the balance sheets of enterprises are approached from different angles and answers to different questions are sought. Indicators such as growth, profitability, volume of sales, ability to use resources effectively and efficiently, indebtedness level, debt repayment ability, and the firm's position in the market, which are the determinants of the financial performance of enterprises, are analysed with the help of different ratios and the financial performance of the enterprise is analysed (Aydın, 2012). While making this analysis, many criteria should be taken into consideration and evaluation should be made in the light of these criteria. For this reason, it is a very common method to use multi-criteria decision-making (MCDM) methods that allow evaluation by considering many different criteria when analysing the financial performance of enterprises.

In this study, it is aimed to analyse the financial performance of enterprises with the help of financial ratios obtained from their balance sheets. For this purpose, the multi-attribute boundary approximation area comparison (MABAC) method developed by Pamucar and Cirovic (2015), which has recently been widely used, was used.

## 1. Literature Review

In this section, the most prominent national and international studies on the subject are summarized from the most recent to the oldest.

Çetin and Karataş (2024) analysed the profitability of 8 automotive companies traded on BIST between the years 2013-2022. Using 7 profitability ratios as criteria in their analysis, the authors analysed the profitability performance of the companies with LOPCOW and MABAC methods, which are MCDM methods. As a result of the study, the authors concluded that Otokar Otomotiv ve Savunma Sanayi A.Ş. (OTKAR) for the years 2020 and 2021 and Doğuş Otomotiv Servis ve Ticaret A.Ş. (DOAS) for the year 2022 showed the best performance.

Topal (2024) analysed the financial performance of the firms traded in the Stone and Soil Based Sector of Borsa Istanbul (BIST). Using 12 financial ratios (Current Ratio, Cash Ratio, Acid-Test Ratio, Net Profit Margin, Operating Profitability, Return on Equity, Financial Leverage, Growth in Sales, Inventory Turnover, Asset Turnover, Equity Turnover and

Earnings per Share) as criteria, the author weighted these criteria using AHP and ENTROPI methods and used TOPSIS method for performance ranking. As a result of the study, it was observed that the best performing cement companies in both weighting methods were the same in all years.

Aydın and Sevinç (2024) conducted a comparative performance evaluation of the software sector with Turkey average and NUTS Level I average by using the financial data between 2018-2022. Using the CRITIC method (Criteria Importance Through Intercriteria Correlation) for weighting the criteria and the MABAC method (The Multi-Attributive Border Approximation Area Comparison) for performance ranking by years, the authors concluded that the software sector performance in NUTS Level I regions was generally higher in 2020 and lower in 2019.

Nurhidayat and Thamrin (2023) analysed the financial performance of automotive companies listed on the Indonesia Stock Exchange (IDX) between 2011 and 2021 using panel data regression analysis. As a result of the analysis, the authors concluded that automotive companies should take working capital management into account when formulating optimal capital budgeting practices and also concluded that working capital management is very important on company profitability.

Gökdemir (2023) aimed to determine the effects of the COVID-19 pandemic process on the financial performance of banks traded on the BIST and to analyse the financial performance of banks in this period. The author weighted the criteria used in the study with CRITIC and DEMATEL methods and made financial performance rankings with VIKOR, TOPSIS and PROMETHEE II methods. As a result of the study, it was concluded that PROMETHEE II is the best method for ranking performance, while VIKOR method is the worst method.

Yavuz and Sönmez (2023) analysed the performance of the companies in the BIST Corporate Governance Index by using data for the period 2019-2021. The authors used return on assets, return on equity, gross profit margin, profit margin, EBITDA margin, earnings per share and market capitalisation/book value ratios as criteria. The authors used CRITIC and ENTROPI methods to weight the criteria and MABAC method for performance ranking. At the end of the study, the authors compared the performance rankings obtained by ENTROPI-MABAC and CRITIC-MABAC methods and determined that the company with the best performance in 2019 was LOGO, and the company with the best performance in 2020 and 2021 was PRKME.

Çilek (2022) aimed to create an optimal portfolio for companies traded in the BIST real estate investment trust index using the SD-MABAC method. In the study where the data set covers the years 2019-2021 and 35 companies were analysed, 9 different financial ratios were determined as criteria. In the analysis conducted as a result of the study, Alarko Gayrimenkul Yatırım Ortaklığı A.Ş. (ALGYO) was the most successful company in 2019 and 2020, while Pera Yatırım Holding A.Ş. (PEGYO) was the most successful company in 2021.

Lukic (2021), who used the MABAC method in his study on sector productivity in Serbia, found that the wholesale and retail sector and motor vehicle repair sector ranked first in terms of productivity. In addition, he revealed that the wholesale and retail sector and the motor vehicle repair sector were the sectors least affected by the pandemic during the coronavirus epidemic. The author also found that transport and warehousing, banks, and catering and accommodation services sectors were the sectors that significantly felt the negative impact of the coronavirus outbreak on productivity.

Acuner and Kaygın (2021) analyzed the financial performance of 33 companies in the BIST Sustainability Index using 2019 data. The authors used integrated Entropy and Multi-Attribute Boundary Approach Field Comparison (MABAC) methods and used 7 financial ratios as evaluation criteria. As a result of the study, it is concluded that firms with high equity capital have high financial performance, while firms with low earnings per share ratios have low financial performance.

Kablan and Altuk (2021), analyzed the financial performance of the Public Audit Institution for the period 2014-2018 with TOPSIS and MABAC methods. As a result of the study, it was observed that the performance measurement results differed in the two methods used. While the best performance year was found to be 2016 in the analysis using the TOPSIS method, the best performance year was found to be 2017 in the analysis using the MABAC method.

Arslan et al. (2021) aimed to determine the most suitable technopark location for companies planning to operate in the IT sector in Istanbul and Izmit. In the study using entropy and ARAS method, the most suitable technopark location was determined as ITU Technopark, while the second most suitable technopark location was determined as Yıldız Technopark.

Akbulut (2020) analyzed the relationship between the financial performance and stock returns of 18 companies operating in the BIST cement sector for the periods covering 2014-2018. The author determined 8 evaluation criteria to evaluate financial performance and used the CRITIC method to determine the weights of these criteria. In the study, the

MABAC method was used to evaluate the financial performance and to determine the success scores of the alternatives. According to the ranking values obtained as a result of the analysis, it was determined that the 3 most financially successful companies among the companies operating in the BIST Cement Sector are ADANA, ADBGR and KONYA. As a result of the study, it was concluded that there is a positive and moderately significant relationship between the performance ranking (CRITIC- MABAC) and the stock return ranking.

Apan and Öztel (2020) analyzed the cash flow-oriented financial performance of 15 companies traded in the Forest Paper and Paper Printing Index using the Integrated Entropy and EDAS methods. As a result of the study covering the years 2011-2018, KARTN and GENTS were identified as the companies with the best financial performance in all years except 2015. The companies with the worst financial performance were SAMAT and HURGZ.

Karcıoğlu et al. (2020) analyzed the financial performance of 8 energy companies in Borsa Istanbul between 2013 and 2017. The authors used 13 financial ratios as evaluation criteria and used the Entropy and Intuitionistic Fuzzy logic method. As a result of the study, the best performing companies were found to be respectively Odaş and Aksu Enerji, while the worst performing companies were found to be Aksa Elektrik and Ayen Elektrik.

Çanakçıoğlu and Küçükönder (2020) analyzed the financial performance of 21 enterprises traded in the food and beverage index in BIST in 2014-2018 by using Entropy and TOPSIS methods. As a result of the analysis, it was concluded that Konfrut Gıda Sanayi ve Ticaret A.Ş. showed the highest financial performance in 2014, while Türk Tuborg Bira ve Malt Sanayii A.Ş. showed the highest financial performance in all other years.

Ulutaş (2019) used 8 criteria in his study on the selection of a manager for the marketing department of a furniture workshop using ENTROPI and MABAC methods. In the analysis, the selection was completed by ranking the candidates from the most suitable to the least suitable with the MABAC method.

Akgınel, (2019), it was aimed to compare the financial performance of companies operating in the IT sector according to years by using TOPSIS and VIKOR method, which are among the multi-criteria decision-making techniques. As a result of the study, it was observed that the financial performance of the companies varied over the years and the methods used created differences in the performance rankings of the companies.

Shaverdi et al. (2016) aimed to evaluate the competitiveness of 7 petrochemical companies traded on the Tehran Stock Exchange between 2003 and 2013 by using the Fuzzy TOPSIS method. Using 15 financial ratios obtained from the financial statements of the companies between 2003-2013 as evaluation criteria, the authors ranked 7 companies in terms of competitiveness and concluded that the weight ratios were very close to each other. 6 of the 7 companies were ranked in terms of competitiveness.

Sueyoshi and Goto (2013) compared Japanese IT and manufacturing firms listed on the Tokyo Stock Exchange. The empirical evidence revealed that research and development expenditures increase the corporate value of IT and manufacturing enterprises. They also concluded that the research and development expenditures of IT sector enterprises are much more important than the research and development expenditures of manufacturing sector enterprises.

## 2. Method

Financial performance evaluation of companies operating in BIST is very important for both company managers and investors in a competitive environment to achieve their investment targets. Since the evaluation process reflects the profitability of a company, financial performance measures should be analysed accurately. Financial performance analysis is an effective analysis management that can reveal the financial strengths and weaknesses of companies, and also helps managers to obtain appropriate strategies that the company should follow in order to achieve certain goals.

The financial performance evaluation model proposed in this study consists of two steps. In the first step, the Entropy method is used to determine the weights of the criteria, and in the second step, the multi-attribute boundary approximation area comparison (MABAC) method is applied to determine the performance ranking of the selected companies.

In this study, 12 financial ratios determined to measure financial performance were used as criteria. Entropy Method was used to determine the weights of the criteria affecting the performance and MABAC Method was used to determine the company with the highest performance. The MABAC method is a relatively new model for the recently developed MCDM approach (Pamucar and Ćirović, 2015). The MABAC method has recently been widely used to determine the order of alternatives in solving problems in many different fields (Şahin and Altun, 2020). The MABAC method has both a simple computational technique and a robust approach close to human decision-making logic.

### 2.1. MABAC Method Application Steps

The multi-attribute boundary approximation domain comparison (MABAC) method is a new distance-based method recently developed by the research centre at the Defence University in Belgrade (Pamucar and Ćirović, 2015). It is based on calculating the values of the criterion functions for the alternatives and defining the distance of the criterion function from the boundary approximation domain. Accordingly, all alternatives can be included in the boundary (G), upper (G+) or lower (G-) approximation domain. The alternatives can then be ranked.

The first study of the MABAC method demonstrated its simple computational process and its stability in solution through in-depth comparison and sensitivity analyses. To date, the MABAC method has been combined with various uncertainty theories. Moreover, the method has been applied in various fields related to healthcare, waste treatment technologies (Shi et al., 2017), failure mode and effect analysis (Liu et al., 2019) and hospital management (Sun et al., 2018).

In a decision making problem, let A = $\{A_1, A_{2,} \dots, A_i\}$ be the set of alternatives and C= $\{C_1, C_2, \dots, C_j\}$ be the set of criteria. Let $A_i$ be alternative *i* and $C_j$ be criterion *j*. Let $r_{ij}$ denote the performance value of alternative $A_i$ with respect to criterion $C_j$. $W = \{w_1, w_2, \dots, w_n\}$ is the weight vector of the criteria $\sum_{j=1}^{n} w_j = 1, w_j \in [0,1]$.

The MABAC method is seen in defining the distance of each alternative from the boundary approximation area of the criterion function. It is a multi-criteria decision-making approach and its steps can be summarised as follows (Pamucar and Cirovic, 2015).

*Step 1. Obtaining initial decision matrix*

$R = [r_{ij}]_{m\times n}$ decision matrix, where $r_{ij}$ is the performance value of alternative $A_i$ according to criterion $C_j$, is given as follows.

$$R = [r_{ij}]_{m\times n} = \begin{bmatrix} r_{11} & \cdots & r_{1n} \\ \vdots & \ddots & \vdots \\ r_{m1} & \cdots & r_{mn} \end{bmatrix} \quad (1)$$

*Step 2. Normalisation of the decision matrix*

The purpose of normalisation is to eliminate the difference of attributes in size and order of magnitude. A normalisation process is applied to all data to ensure the general evaluation conditions. This process varies according to the type of benefit and cost of the criteria.

i) If criterion $C_j$ is a utility-type criterion, the normalised value

$$r'_{ij} = \frac{a_{ij} - \min(a_{ij})}{\max(a_{ij}) - \min(a_{ij})}, i = 1,2,\cdots,m; j = 1,2,\cdots,n \quad (2)$$

ii) If criterion $C_j$ is a cost-type criterion, the normalised value

$$r'_{ij} = \frac{\max(a_{ij}) - a_{ij}}{\max(a_{ij}) - \min(a_{ij})}(a_{ij}), i = 1,2,\cdots,m; j = 1,2,\cdots,n. \quad (3)$$

Then the normalised matrix is obtained as $R' = [r'_{ij}]_{m\times n}$ $(i = 1,2,\cdots,m; j = 1,2,\cdots,n)$

*Step 3. Determination of criteria weights*

Criteria weights have a significant impact on the decision-making process. Many different approaches have been presented in the literature to determine these weights. Entropy has an objective point of view that determines the criterion weight by taking into account the uncertainties of the data. A criterion with a small entropy means that it should have a large weight.

where m is the number of alternatives and $h_{ij} = \frac{r_{ij}^{ort}}{\sum_{i=1}^{m}(h_{ij})}$ the entropy of criterion $C_j$ is calculated By the formula;

$$E(j) = -\frac{1}{\ln m}\sum_{i=1}^{m}(h_{ij})\ln(h_{ij})$$

(4)

In particular, when $h_{ij} = 0, (h_{ij})\ln(h_{ij}) = 0$ (Huang vd., 2015). Thus, with n being the number of criteria, the weight value of each criterion calculated by the formula ;

$$w_j = \frac{1-E(j)}{\sum_{j=1}^{n}(1-E(j))}$$

(5)

*Step 4. Determination of weighted average decision matrix*

$r'_{ij}$ is an element of the normalised matrix and $w_i$ (i =1,2,...,m) are the weight values of the criteria.

With the equation $s_{ij} = w_j * h_{ij}, (i = 1,2,\dots,m; j = 1,2,\dots,n)$ (6)

weighted decision matrix $= [s_{ij}]_{m\times n} = \begin{bmatrix} w_1 r_{11} & \cdots & w_n r_{1n} \\ \vdots & \ddots & \vdots \\ w_1 r_{m1} & \cdots & w_n r_{mn} \end{bmatrix} = \begin{bmatrix} s_{11} & \cdots & s_{1n} \\ \vdots & \ddots & \vdots \\ s_{m1} & \cdots & s_{mn} \end{bmatrix}$

(7)

is calculated. Here $s_{ij}$ represents an element of the weighted decision matrix.

*Step 5. Determination of the boundary approach area matrix*

$s_{ij}$ $(i = 1,2,\dots,m; j = 1,2,\dots,n)$being the elements of the weighted matrix and m being the total number of alternatives, the boundary approximation area matrix (SAM) $G = [g_j]_{1\times n} = [g_1, g_2, \dots, g_n]$

$g_j = \prod_{i=1}^{m}(s_{ij})^{1/m}, (i = 1,2,\dots,m; j = 1,2,\dots,n)$, calculated by. (8)

*Step 6. Calculation of the distance measure between alternatives and SAM*

The distance between each alternative and SAM is calculated using the following equation. $D = [d_{ij}]_{m\times n}$for the distance matrix,

$$d_{ij} = \begin{cases} d(c_{ij}, g_j) & if \quad c_{ij} \geq g_j \\ -d(c_{ij}, g_j) & if \quad c_{ij} < g_j \end{cases}. \qquad (9)$$

Here $d(s_{ij}, g_j)$;means the distance from $s_{ij}$to $g_j c_{ij}$.

1) If $d_{ij} > 0$, alternatives belong to the upper approximation field $G^{+}(UPF)$
2) If $d_{ij} = 0$, the alternatives belong to the boundary approximation field G$(BAF)$;
3) If $d_{ij} < 0$, the alternatives belong to the lower approximation field $G^{-}(LAF)$

Obviously, the best alternatives are found in $G^{+}(UPF)$ and the worst alternatives are found in $G^{-}(LAF)$). This situation is presented in figure 1 (Pamucar and Cirovic, 2015).

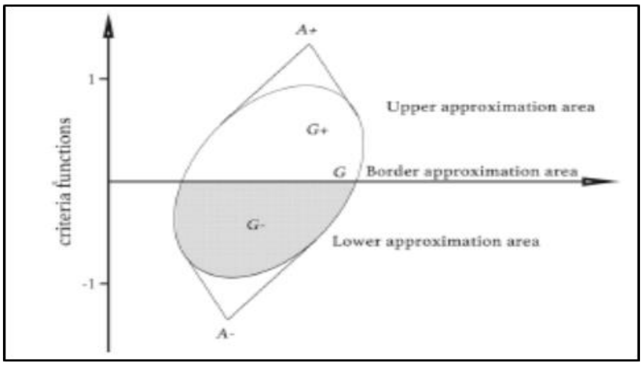



**Figure 1** Representitons of the upper approach G+, lower approach field G- and boundary approach field G

*Step 7. Calculation of extended closeness coefficients of alternatives*

Proximity coefficient for each alternative is calculated by the formula; $\xi_i = \sum_{j=1}^{n} d_{ij}$ (10)

The value of the extended closeness reflects the relative superiority of the alternatives

Step 8. Ranking of alternatives

All alternatives are ranked according to $\xi_i$ $(i = 1,2,\ldots,m)$. A larger $\xi_i$, , $i$. indicates that alternative i is relatively better, while a smaller $\xi_i$ indicates that alternative i is relatively weaker.

## 3. Analysis and Findings

Performance evaluation has been formulated as a typical MCDM problem that selects an alternative or ranks alternatives among a set of alternatives associated with different parameters. In this study, an entropy-based MABAC method is proposed for solving financial evaluation problems. The proposed method is applied to a real case. Performance evaluation decisions are inherently contradictory, so investors want to know the performance and industry ranking of the companies they are considering investing in. Therefore, the problem of the study is to determine the importance of the criteria that reveal the performance value and to rank the companies according to their values in line with these criteria. For the application of the developed method, 12 evaluation criteria were determined by reviewing the literature (Çetin and karakaş,2024; Yavuz and Sönmez 2023; Arslan et al. 2021; Karcıoğlu et al.,2020). Using these criteria, 24 companies in the BIST IT Index between 2019 and 2023 were analysed. Table 1 shows the selected companies and their abbreviations, while Tablo 2 shows the selected evaluation criteria.

**Table 1. Selected Companies**

| Company | Abbreviation | Company | Abbreviation | Company | Abbreviation | Company | Abbreviation |
|---|---|---|---|---|---|---|---|
| ARDYZ | $A_1$ | EDATA | $A_7$ | INTEK | $A_{13}$ | MTRKS | $A_{19}$ |
| ARENA | $A_2$ | ESCOM | $A_8$ | KFEIN | $A_{14}$ | OBASE | $A_{20}$ |
| ATATP | $A_3$ | FONET | $A_9$ | LINK | $A_{15}$ | PENTA | $A_{21}$ |
| AZTEK | $A_4$ | HTTBT | $A_{10}$ | LOGO | $A_{16}$ | PKART | $A_{22}$ |
| DESPC | $A_5$ | INDES | $A_{11}$ | MANAS | $A_{17}$ | SMART | $A_{23}$ |
| DGATE | $A_6$ | INGRM | $A_{12}$ | MIATK | $A_{18}$ | VBTYZ | $A_{24}$ |

**Table 2. Selected Evaluation Criteria**

| Selected Criteria | Abbreviation | Selected Criteria | Abbreviation |
|---|---|---|---|
| Liquid Ratio | $C_1$ | Equity Capital Growth | $C_7$ |
| Return on Assets | $C_2$ | Financial leverage | $C_8$ |
| Net Profit Margin | $C_3$ | Short Term Debt / Total Debt | $C_9$ |
| Return on Equity | $C_4$ | Total Debt / Equity | $C_{10}$ |
| Active Growth | $C_5$ | Asset Turnover Rate | $C_{11}$ |
| Net Sales Growth | $C_6$ | Receivable Turnover Rate | $C_{12}$ |

The application steps of the MABAC model used for financial performance analysis are presented below. In the study, financial performances were calculated separately for 5 years. In order to save space and time, the calculations for the performance ranking for 2019 are shown here. Rankings for other years will be presented in tabular form.

*Step 1.* Firstly, according to the previously determined criteria, the data for each alternative were obtained and the decision matrix was created. The decision matrix created with the data of 2019 is presented in Table 3.

**Table 3. Decision Matrix**

| Alternatives | $C_{1}$ | $C_{2}$ | $C_{3}$ | $C_{4}$ | $C_{5}$ | $C_{6}$ | $C_{7}$ | $C_{8}$ | $C_{9}$ | $C_{10}$ | $C_{11}$ | $C_{12}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $A_{1}$ | 3,83 | 55,71 | 1478,63 | 66,52 | 48,04 | 10,47 | 77,22 | 16,02 | 80,45 | 19,08 | 0,74 | 2,03 |
| $A_{2}$ | 1,21 | 24,17 | 1433,1 | 29,57 | 49,95 | 39,06 | 40,77 | 62,7 | 97,4 | 167,83 | 2,93 | 5,62 |
| $A_{3}$ | 1,16 | 36,52 | 1440,67 | 72,34 | 103,71 | 23,45 | 86,32 | 61,98 | 86,87 | 212,09 | 1,78 | 3,36 |
| $A_{4}$ | 1,64 | 39,99 | 1442,28 | 70,61 | 18,79 | 0 | 19,89 | 61,42 | 79,72 | 159,21 | 1,84 | 2,9 |
| $A_{5}$ | 1,45 | 30,46 | 1436,54 | 38,06 | 45,22 | -19,06 | 20,47 | 48,43 | 98,34 | 93,91 | 2,07 | 3,44 |
| $A_{6}$ | 1,41 | 27,33 | 1434,38 | 42,96 | 41,04 | 38,22 | 43,28 | 52,52 | 98,78 | 180,04 | 2,66 | 5,38 |
| $A_{7}$ | 1,36 | 33,08 | 1437,97 | 44,52 | 68,87 | 16,98 | 44,79 | 51,32 | 96,08 | 105,43 | 2,02 | 3,72 |
| $A_{8}$ | 8,67 | 0 | 0 | 0 | 0 | -31,22 | 0,06 | 4,17 | 92,12 | 4,35 | 0,01 | 0,3 |
| $A_{9}$ | 1,26 | 40,49 | 1461,94 | 46,53 | 27,61 | 37,49 | 47,11 | 15,64 | 73,59 | 18,55 | 0,65 | 7,16 |
| $A_{10}$ | 2,77 | 57,85 | 1465,44 | 68,45 | 75,53 | 56,44 | 80,06 | 20,5 | 70,37 | 25,79 | 1,1 | 7,33 |
| $A_{11}$ | 0,96 | 25,8 | 1433,84 | 44,69 | 66,31 | 35,85 | 36,69 | 76,48 | 98,93 | 420,42 | 2,62 | 5,46 |
| $A_{12}$ | 1,36 | 22,14 | 1432,54 | 25,59 | 45,02 | 18,7 | 36,87 | 75,28 | 86,3 | 309,88 | 2,06 | 3,16 |
| $A_{13}$ | 0,07 | 12,79 | 1399,7 | 0,64 | 30,25 | -6,9 | 0 | 66,62 | 65,16 | 199,56 | 0,26 | 17,71 |
| $A_{14}$ | 3,5 | 34 | 1445,99 | 43,51 | 62,83 | 26,72 | 48,34 | 17,44 | 66,14 | 30,85 | 0,92 | 3,62 |
| $A_{15}$ | 9,13 | 41,86 | 1479,61 | 45,76 | 45,88 | 35,95 | 43,89 | 14,13 | 59,51 | 16,46 | 0,43 | 4,92 |
| $A_{16}$ | 1,53 | 34,13 | 1452,55 | 48,04 | 56,54 | 31,47 | 45,3 | 49,13 | 63,51 | 103,3 | 0,63 | 2,88 |
| $A_{17}$ | 0,38 | 22,71 | 1433,62 | 28,18 | 31,62 | 11,62 | 22,49 | 77,23 | 75,67 | 339,18 | 0,97 | 7,35 |
| $A_{18}$ | 0,82 | 44,13 | 1449,06 | 56,79 | 46,99 | 226,41 | 61,42 | 31,35 | 94,1 | 45,67 | 1,35 | 9,13 |
| $A_{19}$ | 0,99 | 38,61 | 1441,21 | 54,31 | 33,79 | 22,12 | 20,93 | 49,75 | 66,8 | 98,45 | 1,91 | 17,45 |
| $A_{20}$ | 1,49 | 33,12 | 1447,6 | 40,76 | 18,79 | 0 | 19,89 | 36,65 | 75,1 | 57,84 | 0,77 | 3,04 |
| $A_{21}$ | 2,05 | 24,5 | 1433,37 | 45,11 | 50,12 | 6,79 | 29,89 | 86,98 | 42,25 | 667,84 | 2,57 | 4 |
| $A_{22}$ | 1,69 | 30,52 | 1436,23 | 37,6 | 48,87 | 20,42 | 36,64 | 43,28 | 94,09 | 76,29 | 2,25 | 9,2 |
| $A_{23}$ | 2,36 | 34,6 | 1460,96 | 39,53 | 86,82 | 13,98 | 143,35 | 15,95 | 64,39 | 18,98 | 0,46 | 2,98 |
| $A_{24}$ | 1,49 | 33,99 | 1442,03 | 63,2 | 31,08 | 7,67 | 73,3 | 64,58 | 81,59 | 182,35 | 1,28 | 4,29 |

*Step 2.* Decision matrix was normalised using Equation (2-3). The resulting normalised decision matrix is presented in Table 4.

**Table 4. Normalised Decision Matrix**

| | $C_{1}$ | $C_{2}$ | $C_{3}$ | $C_{4}$ | $C_{5}$ | $C_{6}$ | $C_{7}$ | $C_{8}$ | $C_{9}$ | $C_{10}$ | $C_{11}$ | $C_{12}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $A_{1}$ | 0,415 | 0,963 | 0,999 | 0,920 | 0,463 | 0,162 | 0,539 | 0,857 | 0,326 | 0,978 | 0,250 | 0,099 |
| $A_{2}$ | 0,126 | 0,418 | 0,969 | 0,409 | 0,482 | 0,273 | 0,284 | 0,293 | 0,027 | 0,754 | 1,000 | 0,306 |
| $A_{3}$ | 0,120 | 0,631 | 0,974 | 1,000 | 1,000 | 0,212 | 0,602 | 0,302 | 0,213 | 0,687 | 0,606 | 0,176 |
| $A_{4}$ | 0,173 | 0,691 | 0,975 | 0,976 | 0,181 | 0,121 | 0,139 | 0,309 | 0,339 | 0,767 | 0,627 | 0,149 |
| $A_{5}$ | 0,152 | 0,527 | 0,971 | 0,526 | 0,436 | 0,047 | 0,143 | 0,466 | 0,010 | 0,865 | 0,705 | 0,180 |
| $A_{6}$ | 0,148 | 0,472 | 0,969 | 0,594 | 0,396 | 0,270 | 0,302 | 0,416 | 0,003 | 0,735 | 0,908 | 0,292 |
| $A_{7}$ | 0,142 | 0,572 | 0,972 | 0,615 | 0,664 | 0,187 | 0,312 | 0,431 | 0,050 | 0,848 | 0,688 | 0,196 |
| $A_{8}$ | 0,949 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 1,000 | 0,120 | 1,000 | 0,000 | 0,000 |
| $A_{9}$ | 0,131 | 0,700 | 0,988 | 0,643 | 0,266 | 0,267 | 0,329 | 0,861 | 0,447 | 0,979 | 0,219 | 0,394 |
| $A_{10}$ | 0,298 | 1,000 | 0,990 | 0,946 | 0,728 | 0,340 | 0,558 | 0,803 | 0,504 | 0,968 | 0,373 | 0,404 |
| $A_{11}$ | 0,098 | 0,446 | 0,969 | 0,618 | 0,639 | 0,260 | 0,256 | 0,127 | 0,000 | 0,373 | 0,894 | 0,296 |
| $A_{12}$ | 0,142 | 0,383 | 0,968 | 0,354 | 0,434 | 0,194 | 0,257 | 0,141 | 0,223 | 0,540 | 0,702 | 0,164 |
| $A_{13}$ | 0,000 | 0,221 | 0,946 | 0,009 | 0,292 | 0,094 | 0,000 | 0,246 | 0,596 | 0,706 | 0,086 | 1,000 |
| $A_{14}$ | 0,379 | 0,588 | 0,977 | 0,601 | 0,606 | 0,225 | 0,337 | 0,840 | 0,579 | 0,960 | 0,312 | 0,191 |
| $A_{15}$ | 1,000 | 0,724 | 1,000 | 0,633 | 0,442 | 0,261 | 0,306 | 0,880 | 0,695 | 0,982 | 0,144 | 0,265 |
| $A_{16}$ | 0,161 | 0,590 | 0,982 | 0,664 | 0,545 | 0,243 | 0,316 | 0,457 | 0,625 | 0,851 | 0,212 | 0,148 |
| $A_{17}$ | 0,034 | 0,393 | 0,969 | 0,390 | 0,305 | 0,166 | 0,157 | 0,118 | 0,410 | 0,495 | 0,329 | 0,405 |
| $A_{18}$ | 0,083 | 0,763 | 0,979 | 0,785 | 0,453 | 1,000 | 0,428 | 0,672 | 0,085 | 0,938 | 0,459 | 0,507 |
| $A_{19}$ | 0,102 | 0,667 | 0,974 | 0,751 | 0,326 | 0,207 | 0,146 | 0,450 | 0,567 | 0,858 | 0,651 | 0,985 |
| $A_{20}$ | 0,157 | 0,573 | 0,978 | 0,563 | 0,181 | 0,121 | 0,139 | 0,608 | 0,420 | 0,919 | 0,260 | 0,157 |
| $A_{21}$ | 0,219 | 0,424 | 0,969 | 0,624 | 0,483 | 0,148 | 0,209 | 0,000 | 1,000 | 0,000 | 0,877 | 0,213 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **$A_{22}$** | 0,179 | 0,528 | 0,971 | 0,520 | 0,471 | 0,200 | 0,256 | 0,528 | 0,085 | 0,892 | 0,767 | 0,511 |
| **$A_{23}$** | 0,253 | 0,598 | 0,987 | 0,546 | 0,837 | 0,175 | 1,000 | 0,858 | 0,609 | 0,978 | 0,154 | 0,154 |
| **$A_{24}$** | 0,157 | 0,588 | 0,975 | 0,874 | 0,300 | 0,151 | 0,511 | 0,270 | 0,306 | 0,732 | 0,435 | 0,229 |

*Step 3.* The weights of financial ratios are determined using Equation (4-5) and the results are presented in Table 5.

**Table 5. Criteria Weights**

| Criteria | Weight | Criteria | Weight |
|---|---|---|---|
| $C_1$ | 0,132 | $C_7$ | 0,152 |
| $C_2$ | 0,081 | $C_8$ | 0,057 |
| $C_3$ | 0,092 | $C_9$ | 0,058 |
| $C_4$ | 0,073 | $C_{10}$ | 0,029 |
| $C_5$ | 0,088 | $C_{11}$ | 0,090 |

*Step 4.* With the weight information obtained in the previous step, the weighted decision matrix was calculated with the help of Equation (6-7). The results are presented in Table 6.

**Table 6. Weighted Decision Matrix**

| | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | $C_7$ | $C_8$ | $C_9$ | $C_{10}$ | $C_{11}$ | $C_{12}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **$A_1$** | 0,010 | 0,006 | 0,004 | 0,005 | 0,004 | 0,003 | 0,011 | 0,004 | 0,002 | 0,002 | 0,002 | 0,001 |
| **$A_2$** | 0,003 | 0,003 | 0,004 | 0,002 | 0,004 | 0,005 | 0,006 | 0,001 | 0,000 | 0,001 | 0,008 | 0,002 |
| **$A_3$** | 0,003 | 0,004 | 0,004 | 0,005 | 0,008 | 0,004 | 0,012 | 0,001 | 0,002 | 0,001 | 0,005 | 0,001 |
| **$A_4$** | 0,004 | 0,004 | 0,004 | 0,005 | 0,001 | 0,002 | 0,003 | 0,001 | 0,002 | 0,001 | 0,005 | 0,001 |
| **$A_5$** | 0,004 | 0,003 | 0,000 | 0,003 | 0,000 | 0,001 | 0,000 | 0,002 | 0,000 | 0,001 | 0,005 | 0,001 |
| **$A_6$** | 0,003 | 0,000 | 0,004 | 0,003 | 0,003 | 0,005 | 0,006 | 0,002 | 0,000 | 0,001 | 0,007 | 0,002 |
| **$A_7$** | 0,003 | 0,003 | 0,004 | 0,003 | 0,005 | 0,000 | 0,006 | 0,002 | 0,000 | 0,001 | 0,005 | 0,001 |
| **$A_8$** | 0,022 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,005 | 0,001 | 0,002 | 0,000 | 0,000 |
| **$A_9$** | 0,003 | 0,004 | 0,004 | 0,003 | 0,002 | 0,000 | 0,007 | 0,004 | 0,003 | 0,002 | 0,000 | 0,000 |
| **$A_{10}$** | 0,007 | 0,006 | 0,004 | 0,005 | 0,006 | 0,006 | 0,011 | 0,004 | 0,004 | 0,002 | 0,003 | 0,003 |
| **$A_{11}$** | 0,002 | 0,003 | 0,004 | 0,003 | 0,005 | 0,004 | 0,005 | 0,001 | 0,000 | 0,001 | 0,000 | 0,002 |
| **$A_{12}$** | 0,003 | 0,002 | 0,004 | 0,000 | 0,004 | 0,003 | 0,005 | 0,001 | 0,000 | 0,001 | 0,005 | 0,001 |
| **$A_{13}$** | 0,000 | 0,001 | 0,000 | 0,000 | 0,002 | 0,002 | 0,000 | 0,001 | 0,004 | 0,001 | 0,001 | 0,008 |
| **$A_{14}$** | 0,000 | 0,004 | 0,004 | 0,003 | 0,005 | 0,004 | 0,007 | 0,004 | 0,004 | 0,001 | 0,002 | 0,001 |
| **$A_{15}$** | 0,024 | 0,004 | 0,004 | 0,003 | 0,000 | 0,004 | 0,006 | 0,004 | 0,005 | 0,002 | 0,001 | 0,002 |
| **$A_{16}$** | 0,004 | 0,004 | 0,004 | 0,003 | 0,004 | 0,004 | 0,006 | 0,002 | 0,004 | 0,001 | 0,002 | 0,001 |
| **$A_{17}$** | 0,001 | 0,002 | 0,004 | 0,002 | 0,002 | 0,003 | 0,003 | 0,001 | 0,003 | 0,001 | 0,003 | 0,003 |
| **$A_{18}$** | 0,002 | 0,005 | 0,004 | 0,004 | 0,004 | 0,017 | 0,009 | 0,003 | 0,001 | 0,001 | 0,004 | 0,004 |
| **$A_{19}$** | 0,002 | 0,004 | 0,004 | 0,004 | 0,003 | 0,003 | 0,003 | 0,002 | 0,004 | 0,001 | 0,005 | 0,007 |
| **$A_{20}$** | 0,004 | 0,003 | 0,004 | 0,003 | 0,001 | 0,002 | 0,003 | 0,003 | 0,003 | 0,001 | 0,002 | 0,001 |
| **$A_{21}$** | 0,005 | 0,000 | 0,000 | 0,003 | 0,004 | 0,002 | 0,000 | 0,000 | 0,007 | 0,000 | 0,007 | 0,000 |
| **$A_{22}$** | 0,000 | 0,003 | 0,004 | 0,000 | 0,000 | 0,003 | 0,000 | 0,000 | 0,001 | 0,000 | 0,006 | 0,004 |
| **$A_{23}$** | 0,006 | 0,000 | 0,004 | 0,003 | 0,007 | 0,003 | 0,000 | 0,004 | 0,004 | 0,002 | 0,001 | 0,001 |
| **$A_{24}$** | 0,004 | 0,004 | 0,004 | 0,004 | 0,002 | 0,003 | 0,010 | 0,001 | 0,002 | 0,001 | 0,003 | 0,002 |

*Step 5.* Using Equation 8, the boundary approximation field matrix (SAM) $G = [g_j]_{1\times12} = [g_1, g_2, \ldots, g_{12}]$ is calculated and presented as follows.

$$G = \begin{bmatrix} 0{,}00148; 0{,}00078; 0{,}00091; 0{,}00082; 0{,}00081; 0{,}00116; \\ 0{,}00068; 0{,}00114; 0{,}00082; 0{,}00069; 0{,}00115; 0{,}00073 \end{bmatrix}$$

*Step 6.* The distance measure between alternatives and SAM was calculated using Equation 9 and the distance matrix $D = [d_{ij}]_{24\times12}$ is given in Table 7.

**Table 7. Distance Measure Values**

| | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | $C_7$ | $C_8$ | $C_9$ | $C_{10}$ | $C_{11}$ | $C_{12}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $A_1$ | 0,008 | 0,005 | 0,003 | 0,004 | 0,003 | 0,002 | 0,010 | 0,003 | 0,001 | 0,001 | 0,001 | 0,000 |
| $A_2$ | 0,001 | 0,002 | 0,003 | 0,001 | 0,003 | 0,003 | 0,005 | 0,000 | -0,001 | 0,000 | 0,007 | 0,002 |
| $A_3$ | 0,001 | 0,003 | 0,003 | 0,004 | 0,007 | 0,002 | 0,011 | 0,000 | 0,001 | 0,000 | 0,004 | 0,001 |
| $A_4$ | 0,003 | 0,003 | 0,003 | 0,004 | 0,001 | 0,001 | 0,002 | 0,000 | 0,002 | 0,001 | 0,004 | 0,000 |
| $A_5$ | 0,002 | 0,002 | -0,001 | 0,002 | -0,001 | 0,000 | -0,001 | 0,001 | -0,001 | 0,001 | 0,004 | 0,001 |
| $A_6$ | 0,002 | -0,001 | 0,003 | 0,002 | 0,002 | 0,003 | 0,005 | 0,001 | -0,001 | 0,000 | 0,006 | 0,001 |
| $A_7$ | 0,002 | 0,003 | 0,003 | 0,002 | 0,005 | -0,001 | 0,006 | 0,001 | 0,000 | 0,001 | 0,004 | 0,001 |
| $A_8$ | 0,021 | -0,001 | -0,001 | -0,001 | -0,001 | -0,001 | -0,001 | 0,004 | 0,000 | 0,001 | -0,001 | -0,001 |
| $A_9$ | 0,002 | 0,003 | 0,003 | 0,002 | 0,001 | -0,001 | 0,006 | 0,003 | 0,002 | 0,001 | -0,001 | -0,001 |
| $A_{10}$ | 0,006 | 0,005 | 0,003 | 0,004 | 0,005 | 0,005 | 0,011 | 0,003 | 0,003 | 0,001 | 0,002 | 0,002 |
| $A_{11}$ | 0,001 | 0,002 | 0,003 | 0,002 | 0,004 | 0,003 | 0,004 | -0,001 | -0,001 | 0,000 | -0,001 | 0,002 |
| $A_{12}$ | 0,002 | 0,002 | 0,003 | -0,001 | 0,003 | 0,002 | 0,005 | 0,000 | -0,001 | 0,000 | 0,004 | 0,001 |
| $A_{13}$ | -0,001 | 0,001 | -0,001 | -0,001 | 0,002 | 0,000 | -0,001 | 0,000 | 0,003 | 0,000 | 0,000 | 0,007 |
| $A_{14}$ | -0,001 | 0,003 | 0,003 | 0,002 | 0,004 | 0,003 | 0,006 | 0,003 | 0,003 | 0,001 | 0,001 | 0,001 |
| $A_{15}$ | 0,022 | 0,004 | 0,003 | 0,002 | -0,001 | 0,003 | 0,006 | 0,003 | 0,004 | 0,001 | 0,000 | 0,001 |
| $A_{16}$ | 0,002 | 0,003 | 0,003 | 0,003 | 0,004 | 0,003 | 0,006 | 0,001 | 0,004 | 0,001 | 0,000 | 0,000 |
| $A_{17}$ | -0,001 | 0,002 | 0,003 | 0,001 | 0,002 | 0,002 | 0,002 | -0,001 | 0,002 | 0,000 | 0,001 | 0,002 |
| $A_{18}$ | 0,000 | 0,004 | 0,003 | 0,003 | 0,003 | 0,016 | 0,008 | 0,002 | 0,000 | 0,001 | 0,002 | 0,003 |
| $A_{19}$ | 0,001 | 0,003 | 0,003 | 0,003 | 0,002 | 0,002 | 0,002 | 0,001 | 0,003 | 0,001 | 0,004 | 0,007 |
| $A_{20}$ | 0,002 | 0,003 | 0,003 | 0,002 | 0,001 | 0,001 | 0,002 | 0,002 | 0,002 | 0,001 | 0,001 | 0,000 |
| $A_{21}$ | 0,004 | -0,001 | -0,001 | 0,002 | 0,003 | 0,001 | -0,001 | -0,001 | 0,006 | -0,001 | 0,006 | -0,001 |
| $A_{22}$ | -0,001 | 0,002 | 0,003 | -0,001 | -0,001 | 0,002 | -0,001 | -0,001 | 0,000 | -0,001 | 0,005 | 0,003 |
| $A_{23}$ | 0,004 | -0,001 | 0,003 | 0,002 | 0,006 | 0,002 | -0,001 | 0,003 | 0,003 | 0,001 | 0,000 | 0,000 |
| $A_{24}$ | 0,002 | 0,003 | 0,003 | 0,004 | 0,002 | 0,001 | 0,010 | 0,000 | 0,001 | 0,000 | 0,002 | 0,001 |

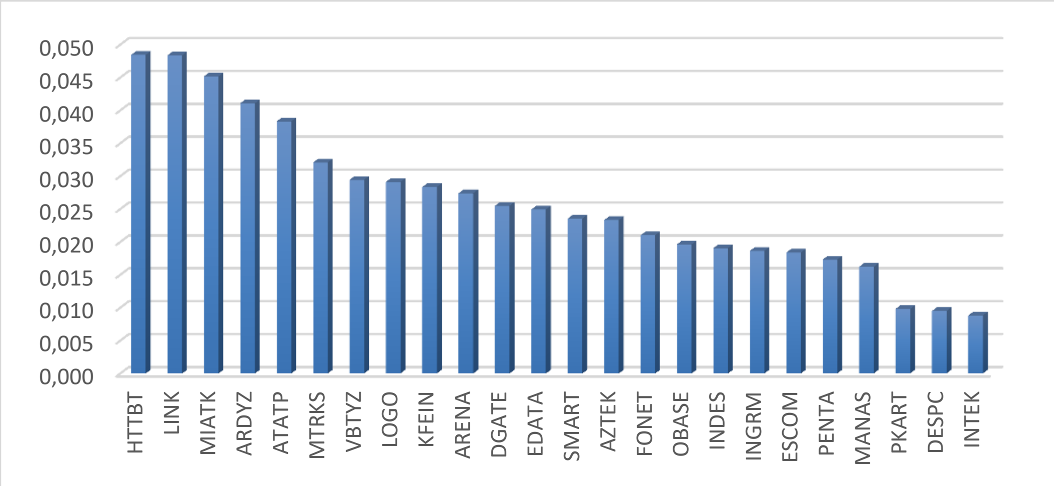
*Step 7.* The extended degree of closeness $\xi_i$ $(i = 1,2, \ldots, 24)$ of each alternative was calculated using Equation (10) and the results are listed in Table 8.

**Table 8. Extended Proximity Degrees of Alternatives**

| | $\xi_i$ | | $\xi_i$ | | $\xi_i$ | | $\xi_i$ |
|---|---|---|---|---|---|---|---|
| $A_1$ | 0,04109 | $A_7$ | 0,02494 | $A_{13}$ | 0,00883 | $A_{19}$ | 0,03208 |
| $A_2$ | 0,02740 | $A_8$ | 0,01837 | $A_{14}$ | 0,02834 | $A_{20}$ | 0,01964 |
| $A_3$ | 0,03834 | $A_9$ | 0,02101 | $A_{15}$ | 0,04838 | $A_{21}$ | 0,01732 |
| $A_4$ | 0,02333 | $A_{10}$ | 0,04845 | $A_{16}$ | 0,02912 | $A_{22}$ | 0,00981 |
| $A_5$ | 0,00949 | $A_{11}$ | 0,01907 | $A_{17}$ | 0,01622 | $A_{23}$ | 0,02356 |
| $A_6$ | 0,02550 | $A_{12}$ | 0,01864 | $A_{18}$ | 0,04518 | $A_{24}$ | 0,02944 |

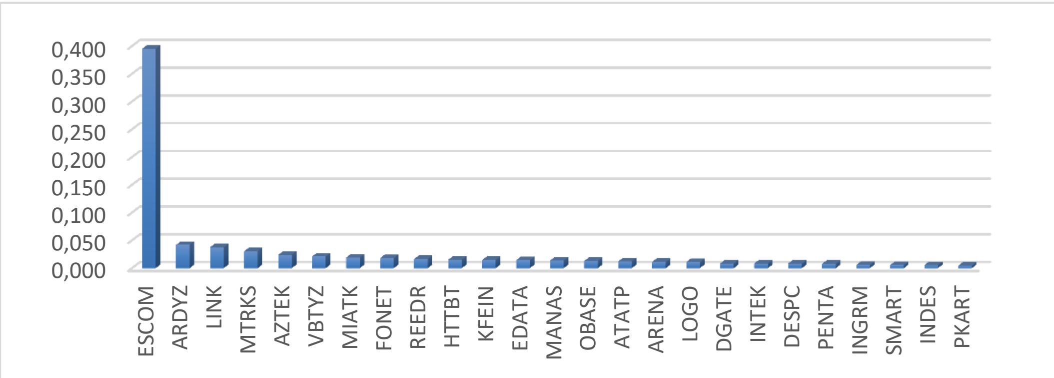
Performance rankings were made by applying the same steps in other years (2020, 2021, 2022, 2023). Here, in order to save time and space, the results obtained for other years will be presented graphically.

When the performance rankings according to years are analysed; HTTBT was the company that ranked first in 2019, while Link Bilgisayar Sistemleri Yazılımı ve Donanımı Sanayi ve Ticaret A.Ş. (LINK), which has almost the same score, ranked second and Mia Teknoloji A.Ş. (MIATK) ranked 3rd. The worst performing company was Innosa Teknoloji A.Ş. (INTEK), followed by Despec Bilgisayar Pazarlama ve Ticaret A.Ş. (DESPC) and Plastikkart Akıllı Kart İletişim Sistemleri Sanayi ve Ticaret A.Ş. (PKART).



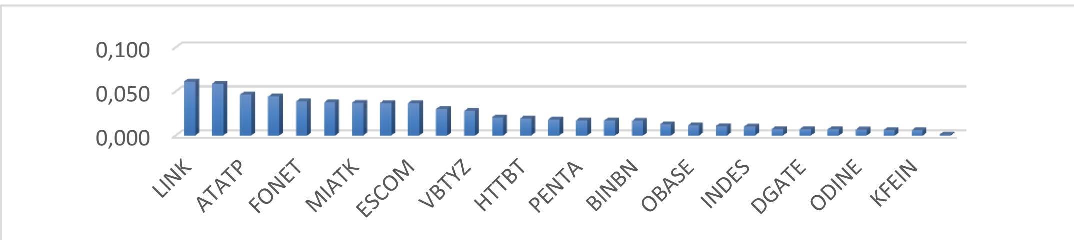

**Graph 1. 2019 Performance Ranking**

As a result of the analysis for 2020, the best performing company was Escort Computer Elektronik Sanayi ve Ticaret A.Ş. (ESCOM), followed by Ard Grup Bilişim Teknolojileri A.Ş. (ARDYZ) and LINK companies, respectively. The worst performing company in 2020 was PKART, followed by Indeks Bilgisayar Sistemleri Sanayi ve Ticaret A.Ş. (INDES) and Smartiks Yazılım A.Ş. (SMART), respectively.



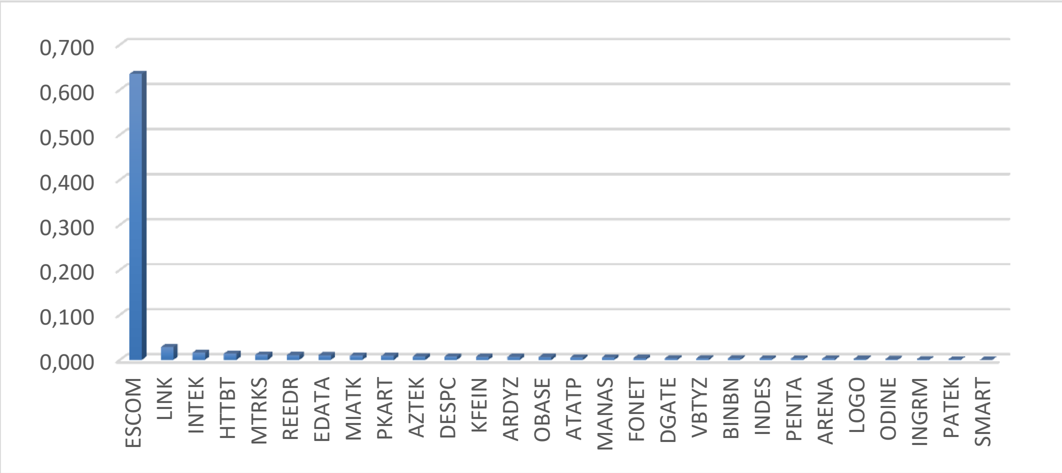

**Graph 2. 2020 Performance Ranking**

In 2021, when we evaluate the performance ranking for the year 2021, it was observed that LINK performed the best. The second best performance was shown by INTEK, followed by Atp Ticari Bilgisayar Ağı ve Elektrik Güç Kaynakları Üretim Pazarlama ve Ticaret A.Ş. (ATATP). Pasifik Donanım ve Yazılım Bilgi Teknolojileri A.Ş. (PATEK) showed the worst performance, while Kafein Yazılım Hizmetleri Ticaret A.Ş. (KFEIN) and Despec Bilgisayar Pazarlama ve Ticaret A.Ş. (DESPC) were also among the companies with poor performance.



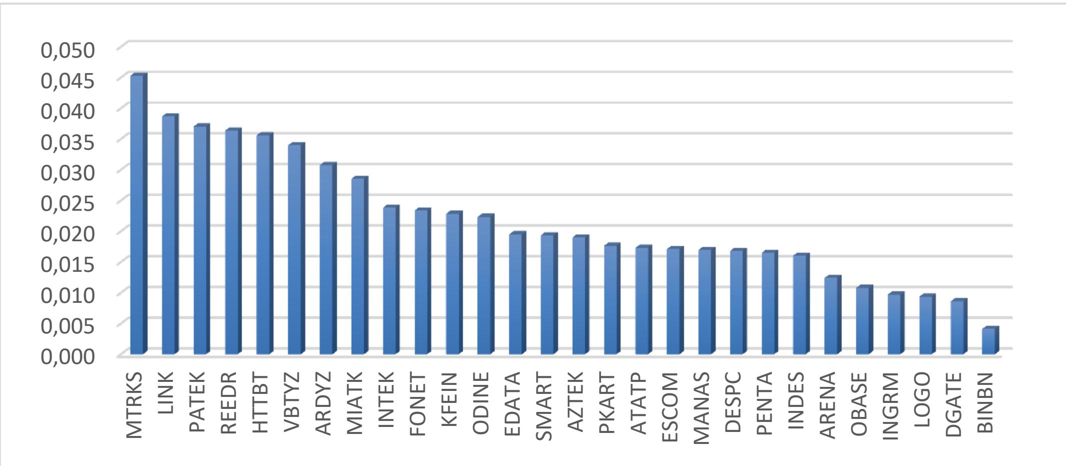
**Graph 3. 2021 Performance Ranking**

In 2022, the best performing companies were ESCOM, LINK and INTEK, while the worst performing companies were Ingram Micro Bilişim Sistemleri A.Ş (INGRM), PATEK and SMART.




**Graph 4. 2022 Performance Ranking**

Finally, when the analysis for 2023 is analysed, it is seen that Matriks Finansal Teknolojiler A.Ş. (MTRKS) has the best performance, followed by LINK and PATEK companies respectively.When we look at the companies with the worst performance for 2023, BİN ULAŞIM VE AKILLI ŞEHİR TEKNOLOJİLER A.Ş. (BINBN) ranks first, followed by Datagate Bilgisayar Malzemeleri Ticaret A.Ş. (DGATE) and Logo Yazılım Sanayi Ve Ticaret A.Ş. (LOGO) companies respectively.




**Graph 5. 2023 Performance Ranking**

## Conclusion and Recommendations

The transition from the industrial society to the information society, together with the effect of globalisation, the fields of activity and production processes of enterprises have experienced a serious change. This change has made itself felt very rapidly in almost all sectors. In particular, the increasing competitive pressure with globalisation has become the biggest problem of enterprises and therefore of countries. Countries and businesses have to adapt their business processes to new generation technologies and digitalisation as much as possible in order to gain advantage in this increasing competitive environment.

The most important stakeholder of this rapid and major change and transformation process is undoubtedly the information sector. The change in the information sector has been a driving force for countries and businesses. For this reason, countries that can achieve a good pace of change and development in the IT sector have a competitive advantage in the international arena.

The increasing pace of change and development in the IT sector has become a determinant in both national and international competition for enterprises in this sector. Unfortunately, businesses that cannot catch up with this pace of change have serious difficulties in sustaining their existence. For this reason, it is extremely vital for enterprises in the IT sector to measure their own performance accurately, determine their strengths and weaknesses and make improvements in these areas.

In recent years, MCDM methods have been used in the measurement of business performances. MCDM methods are methods that offer the opportunity to make an evaluation by using different criteria and weighting these criteria with certain methods. In this study, the financial performances of the enterprises traded on BIST in the IT sector between 2019-2023 were analysed. When the literature is examined, it is seen that financial ratios obtained from the balance sheets of enterprises are widely used as evaluation criteria in the financial performance analysis of enterprises. From this point of view, 12 financial ratios obtained from the balance sheets were used as evaluation criteria with the help of the literature review and expert opinions we consulted.

In the study, firstly, a decision matrix containing the evaluation criteria for each alternative was formed. Then, the weights of these criteria were calculated with the help of entropy. In the calculation, the criterion with the highest weight ratio was Total Debt / Equity capital, while the criterion with the lowest weight ratio was net profit margin and growth in equity capital. After the criteria weights were calculated, the weighted criteria matrix was formed. Afterwards, distance measure values were calculated and then the extended closeness degrees of the alternatives were found.

When the analyses are examined, it is seen that LINK has consistently performed well, ranking first in 2021 and second in the other years, and is the best performing company over the 5-year period. In addition, it is seen that ESCOM is the first ranked company in 2020 and 2022, while in other years it is in the middle ranks. Again, when we look at the ranking table, it can be stated as another remarkable result that PKART company performed poorly in 2019 and 2020, but recovered in the following years. INTEK company, like PKART company, is another company that performs well in other years after performing poorly in the first year. When the ranking table is analysed, it can be seen that LOGO Company performed well in the first years and then gradually decreased its performance and performed poorly in the other years. Another noteworthy result is that the performance of INGRM company has gradually deteriorated and is among the worst performing companies in the last two years.

The ranking table shows that some companies have performed well over the years, some have shown a fluctuating performance, and some have shown consistently poor performance. From the investor's point of view, companies that perform consistently well and transition from poor performance to good performance over the years can offer positive returns to investors. Investors can benefit from the opportunities offered by these companies by analysing these companies well and following the performance changes over the years. In terms of businesses, in order for businesses to continue their existence, they need to analyse the results of their activities well. From this point of view, a good financial performance analysis is of vital importance for businesses. As a result of a good performance analysis, improving the decision-making criteria and indicators of the enterprises will benefit the companies both to maintain their existence and to improve their competitiveness.

Determining criterion weights is an important process when using MCDM methods. This is the most important detail that determines which alternative will show the best performance. For this reason, using different methods to determine the criteria weights will lead to different results. In this study, entropy method was used to determine the criteria weights. If a different method is used, a different alternative is likely to be the best alternative. Although CRM methods are useful in situations such as selecting the best alternative among alternatives and ranking them, they are criticised by researchers due to different results when different criteria weighting techniques are used. The MABAC method used in this study is a newly developed method and the number of studies is limited. Therefore, this study is expected to contribute to the development of the literature and to be a guide for new researchers.

In this study, the financial performance of the companies in the IT index is analysed by MABAC method. In the analysis, entropy method was used to determine the criteria weights. In future studies, financial performance analyses using different criteria weighting methods can be compared and it can be investigated which method will give better results for this analysis. In addition, in future studies, financial performance can be analysed by using different MCDM methods and it can be investigated which CRM method gives better results for financial performance analysis.

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