INTERNATIONAL STUDIES IN ECONOMICS AND ADMINISTRATIVE SCIENCES

EDİTÖR **PROF. DR. MUSTAFA METE**

SERÜVEN YAYINEVİ

Genel Yayın Yönetmeni / Editor in Chief • C. Cansın Selin Temana

Kapak & İç Tasarım / Cover & Interior Design • Serüven Yayınevi

Birinci Basım / First Edition • © MART 2026

ISBN • 978-625-8682-93-9

Serüven Yayınevi / Serüven Publishing
Türkiye Adres / Turkey Address: Kızılay Mah. Fevzi Çakmak 1. Sokak
Ümit Apt No: 22/A Çankaya/ANKARA
Telefon / Phone: 05437675765
web: www.seruvenyayinevi.com
e-mail: seruvenyayinevi@gmail.com

Baskı & Cilt / Printing & Volume
Sertifika / Certificate No: 47083

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Chapter 1

EVALUATION OF ACCOUNTING AND MARKET-BASED PERFORMANCE INDICATORS WITH MULTI-CRITERIA DECISION MAKING METHODS*

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* The summary of this study was presented as a paper at the 11th International Accounting and Finance Research Congress (ICAFR'24) organized in Bartın University on 27-29 September 2024.

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INTRODUCTION

Nowadays, access to financial information that firms need in strategic decision-making processes, analysis of this information and effective use in decision-making processes can be carried out rapidly, independently of time and space constraints, with the effect of digitalization. The increase in the number of publicly traded firms, the diversification of the stakeholder structure, and the intensification of competition have caused information on financial performance indicators to be of critical importance for both firms and investors. In this context, the level of success of firms evaluated based on certain financial indicators has become one of the basic elements that attract the attention of potential investors. Determining the level of success of firms is important not only for investors; but also for those who conduct studies on measuring financial performance (Kotané and Kuzmina-Merlino, 2012; Herciu and Ogrean, 2013; Safaei It has also become an important research area for researchers who focus on analyzing financial performance (Ghadikolaei et al., 2014; Pelloneova and Stichhauerova, 2019) or those who focus on analyzing the main factors affecting financial performance (An and Kim, 2019; Sabbagh et al., 2019; Hojdik , 2020; Remondino , 2020; Zainudin et al., 2021; Riofrio et al., 2023). In many studies in literature, analyses were made by using data obtained from companies' financial statements or capital market information to evaluate firm performance (Tudose et al., 2022).

In the literature, stakeholder preferences regarding financial performance indicators commonly used in evaluating firm performance have changed over time. Traditionally preferred simple and short-term indicators have been replaced by more comprehensive, complex and long-term performance indicators today. This transformation has brought about the use of different types and many financial performance indicators in decision-makers' strategic actions, investors' decision-making processes and academic studies. In this context, the correct selection of financial performance indicators is of great importance in terms of improving firm performance, investors' ability to make rational decisions and increasing the validity and

effectiveness of research (Afonina, 2015; Tudose et al., 2022). Evaluating firm performance is a multidimensional process affected by both internal and external factors. Internal factors such as product and service quality, process efficiency, resource management and innovation, as well as external factors such as competition, economic conditions and customer demands, determine success. A firm must be profitable to achieve sustainable growth. Therefore, financial indicators play a key role in performance evaluations. Effective management of resources and long-term profitability are the basic building blocks of financial success. These indicators are of great importance in terms of attracting investors, ensuring corporate stability and sustaining growth. Companies that do not regularly analyze financial data face the risk of making wrong decisions. Therefore, companies should constantly review their financial structures and make strategic improvements (Riofrio et al., 2023).

Over the years, many indicators and methods have been developed to measure firm performance. Some of these indicators have become widely accepted in both literature and practice over time and have become standards, and some have been included in legal regulations. Thus, these indicators have become usable not only for companies' own internal decisions; but also, by investors, shareholders, consumers and other stakeholders (Cvetkoska and Eftimov, 2021). However, for performance indicators to be effective, they must be selected correctly, and their results must be interpreted correctly. Using the wrong indicators or analyzing the data incorrectly can cause firms to make strategic mistakes (Spitzer, 2007). Therefore, a performance measurement system created with the right indicators makes significant contributions to strategic decision-making and achieving goals (Ittner and Larcker, 1998; Makhija and Trivedi, 2020).

There are many indicators in the literature to measure financial performance. With the diversification of these indicators, two basic approaches have emerged over time, accounting-based performance indicators (traditional) and market-based performance indicators (modern). While traditional measurements include indicators based on accounting

records and financial statements; modern measurements are indicators based on the market value of the firm and investor evaluations (Şenol and Ulutaş, 2018). While accounting-based indicators demonstrate the firm's past performance, market-based indicators allow for the value of the firm to be viewed based on the expectations of investors and the conditions of the marketplace. Consequently, both accounting-based indicators and market-based indicators, when considered separately, offer varying perspectives from which to evaluate firm performance.

Return on Assets (ROA), Return on Equity (ROE) and Earnings Per Share (EPS) are examples of conventional or accounting-based financial performance measurements that are typically studied in literature. ROA is a performance measure that sheds light on the level of profitability attained by a company based on the current assets it has. ROA is a ratio that compares net profit with total assets; it is commonly used in the literature to measure a company's performance with assets and management effectiveness (Putra and Kindangen, 2016; Kurniasari, 2017; Suardana et al., 2018; Wijaya, 2019; Mangantar et al., 2020; Aminah, 2021; Erawati et al., 2022; Astuti et al., 2023; Angela and Nuryani, 2024; Nurhayati et al., 2025; Singh et al., 2024). ROE, in contrast, is a ratio typical to measure how well company management is using equity capital and determines how much of the profit is made from equity capital. ROE, which is net profit divided by total equity, is a fundamental measure of a company's ability to produce value for shareholders (Ahsan, 2012). In this context, it can observed that the ROE indicator has also been used in various studies as an accounting based indicator of performance (Putra and Kindangen, 2016; Kurniasari, 2017; Asri, 2018; Wijaya, 2019; Mangantar et al., 2020; Kartiko and Rachmi, 2021; Erawati et al., 2022; Lungkang & Rusgowanto, 2023; Amelia, 2024; Supriatna, 2025). Likewise, the EPS indicator which is derived from dividing net profit with total shares, is also considered an accounting based performance indicator and used in various studies (Putra & Kindangen, 2016; Cahyaningrum & Antikasari, 2017; Asri, 2018; Supriantikasari & Utami, 2019; Lusiana, 2020; Kartiko & Rachmi, 2021; Gharaibeh et al., 2022; Lungkang & Rusgowanto, 2023; Suraya et al.,

2024; Nurhayati et al., 2025). The EPS is an indicator often used by investors and financial analysts in assessing the company's financial performance and establishing a stock value (De Wet, 2013).

Tobin's Q Ratio, the Market Value/Book Value Ratio (BV/MV), and the Price/Earnings Ratio (P/E) are among the newer performance measures or performance indicators based on market data. Tobin's Q Ratio illustrates the relationship between a company's market value relative to the cost of replacement for the aggregate of its assets. Market value is the market value of the company [(stock price × number of shares) + total liabilities] compared to the replacement cost of the company's total assets (Lim and Mali, 2024). In reviewing the literature, it is evident that Tobin's Q Ratio is a frequently used market performance measure (Fu et al., 2016; Marsha & Murtaqi, 2017; Singh et al., 2018; Cao et al., 2019; Dakhlallah et al., 2020; Ishaq et al., 2021; Chancharat & Kumpamool, 2022; Tambunan, 2023; Suseno et al., 2024; Liniarti et al., 2025). BV/MV is an important indicator often used to compare the market price of the stock of the company as it relates to the company's book value per share. BV/MV provides insight into the market value of a company's shares as it relates to the equity value of a company. The BV/MV measure is calculated by dividing the market price of the share with the book value per share (Ross et al., 2019). This indicator has also been used in successful studies (Clout & Willett, 2016; Jabery & Inanloo, 2017; Kusmayadi et al., 2018; Bustani et al., 2021; Colline, 2022; Tambunan, 2023; Martínez et al., 2024). In the end, P/E is an important market performance indicator which shows the price that investors are willing to pay for one unit of profit earned by the company. This ratio is calculated by dividing the market price per share by the earnings per share. Applying to analyze the relationship between the firm's market value and its expectations for profitability (Brigham & Houston, 2019). In the literature, it can be seen that P/E ratio has a plethora of applications (Kuniawan et al., 2016; Kumar, 2017; Parapat et al., 2018; Rahman & Shamsuddin, 2019; Kasaya & Maniagi, 2020; Sari, 2021; Rahmawati & Hadian, 2022; Sajeetha et al., 2023; Wardana, 2024; Elta, 2025).

The importance of indicators for measuring financial performance in terms of both business management and investor decisions has continuously increased academic interest in this area. In the literature, different perspectives have been developed regarding the determination of the most appropriate criteria that can be used in evaluating firm performance and the extent to which these criteria reflect the reality of the business. However, many studies have addressed performance indicators based solely on financial data. It can be said that there is not enough space given to the weighting and comparison of both accounting-based and market-based indicators with a holistic approach. This study intends to weight accounting and market-based performance measures as per both the views of financial statements and market data and academics that were financial performance experts. Furthermore, based on the established weights, the performance rankings of the companies were established separately based on both data sets, and compared. For this purpose, the financial statements and expert opinions data sets where performance indicators based on accounting and market-based performance measures were analysed using Multi-Criteria Decision Making (MCDM) techniques. The performance measures indicator was weighted using the ENTROPY method for the financial statements and market indicators, and DEMATEL for the expert opinions. Based on the weights, the MABAC method was followed to establish a performance ranking for the companies, and the rankings were compared using Spearman rank correlation analysis. The objective and subjective data sets, and comparison, as used in the study, demonstrate originality and its contribution to literature. Moreover, the utilization of data from firms operating in the Borsa Istanbul (BIST) information sector (IT) supports the originality of the research in the context of the sector. In this respect, the research not only provides an empirical illustration of the use of MCDM methods in financial analysis processes but also unveils the differences between accounting-based and market-based indicators that are commonly mentioned in the literature. As a result, it is thought that this research will contribute to literature in terms of providing a multidimensional perspective to financial performance analysis, including

methodological diversity, and building a bridge between empirical practice and theory.

METHOD

Two separate data sets were used within the scope of the research. The financial statement and market data in the first data set were obtained from the information published by 21 companies in the BIST IT sector in 2023. The second data set was created from the opinions of 9 academicians specialized in accounting and finance using a semi-structured interview form.

Based on the data sets obtained, the ENTROPY method was used to calculate the weights of accounting and market-based variables that reveal firm performance according to financial statement and market data, and the DEMATEL method was used to calculate according to data obtained from experts. The MABAC method was used to create alternative rankings based on the weights calculated according to both data sets. Finally, Spearman Rank Correlation Analysis was used to test whether there was a relationship between the rankings obtained from ENTROPY-MABAC and DEMATEL-MABAC methods.

DEMATEL METHOD

The DEMATEL method calculates the weights of variables by establishing causal relationships between complex variables, considering the opinions of expert decision makers, without using raw data (Wu and Lee, 2007). The most important feature of the method is that it doesn't require variables to be independent of each other.

The weights are calculated by performing the method in the following six steps (Haste, 2020).

1. Step: Determining the Direct Relationship Matrix

Before creating the direct relationship matrix, decision makers are asked to make pairwise comparisons using scores between 0 and 4. The dimensional direct relationship matrix (A) is created using the averages of the scores given by the decision makers nxn.

Table 1. Numerical Values and Linguistic Expressions

Numerical Values	**Linguistic Expression**
0	Ineffective
1	Low Impact
2	Medium Impact
3	High Impact
4	Very High Impact

2. Step: Normalization of Direct Relationship Matrix

Based on matrix A,

$$X = k * A \tag{1}$$

$$k = \frac{1}{max \sum_{j=1}^{n} a_{ij}}, i, j = 1, 2, \dots, n \tag{2}$$

with values between 0 and 1 X is created using the formulas.

3. Step: Obtaining the Total Relationship Matrix

X Considering the matrix,

$$T = X(I - X)^{-1} \tag{3}$$

The total relationship matrix is obtained by using the equation.

4. Step: Determining the Affecting and Affected Variables

D_i is the total degree of the direct effect of the variable on other variables, R_i being i. the sum of the rows of the total relationship matrix i. shows the total effect of the variable by other variables. $(D_i + R_i)$, i. is the sum of the degrees of affecting and being affected by the variable. $(D_i - R_i)$, i. is the net effect of the variable. $(D_i + R_i) > 0$ if i. means that the variable is affected if it is not affecting.

5. Step: Creating the Relationship Map and Influence Diagram

A threshold value is determined for the removal of effects that are considered insignificant (α). This threshold value can be determined by decision makers or by equation-4.

$$\alpha = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} t_{ij}}{N} \quad (4)$$

If each element in the total relationship matrix is less than the specified threshold value, the element value is written in the same way if it is not zero. A relationship map and influence diagram are created according to the new matrix created.

6. Step: Determining Variable Weights

$(D_i + R_i)$ and $(D_i - R_i)$ the criterion weights are calculated using equations (5) and (6).

$$S_i = \sqrt{(D_i + R_i)^2 + (D_i - R_i)^2}\,, i = 1, 2, \dots, n \quad (5)$$

$$w_i = \frac{S_i}{\sum_{i=1}^{n} S_i} \quad (6)$$

ENTROPY METHOD

The ENTROPY method was first developed in the literature by Rudolph Clausius in 1965 to determine the importance levels of criteria (Eş & Eğilmez,

2024). The ENTROPY technique is used to assess importance level of each criterion depending on the amount of information received from the available data.

The process steps of the ENTROPY method have a strong tradition of use in physical and social sciences and were created by Claude Shannon in 1948. The ENTROPY method is one of the techniques that helps in calculating weights objectively and not depending on the opinions and evaluation of experts when determining the importance levels of the criteria (Akçanat, Eren, Aksoy, & Ömürbek, 2017).

In ENTROPY method, the criteria weights can be determined only on the initial matrix, and it is highly practical and beneficial as it does not require criteria to be evaluated separately.

ENTROPY method is based 5 steps (Arslan, 2020).

1. Step: Creating the Decision Matrix

A decision matrix consisting of m number of alternatives and n number of criteria is created as follows.

$$X_{ij} = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{21} & \dots & X_{2n} \\ \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots \\ X_{m1} & X_{m2} & \dots & X_{mn} \end{bmatrix} \forall_i = 1,2,\dots,m \; \forall_j = 1,2,\dots,n$$

2. Step: Creating the Normalized Decision Matrix

The decision matrix created in step 1 is normalized using equation 7. The normalized decision matrix is created as follows.

$$x_{ij} = \frac{x_{ij}}{\sum_{i=1}^{n} x_{ij}} \tag{7}$$

$$X_{ij}^{*} = \begin{bmatrix} X_{11}^{*} & X_{12}^{*} & \dots & X_{1n}^{*} \\ X_{21}^{*} & X_{22}^{*} & \dots & X_{2n}^{*} \\ \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots \\ X_{m1}^{*} & X_{m2}^{*} & \dots & X_{mn}^{*} \end{bmatrix}$$

3. Step: Calculating Entropy Values

The entropy values of all criteria are calculated using equation 8. Here k is a constant value and $k = \frac{1}{\ln(m)}$is calculated as. Here m is the number of alternatives.

$$E = -k \sum_{i=1}^{m} X_{ij} ln X_{ij} \quad (8)$$

4. Step: Calculating Degrees of Differentiation

The degree of differentiation of all criteria, namely d_j are calculated using equation 9.

$$d_j = 1 - E_j \quad (9)$$

5. Step: Calculating Criteria Weights

The weights of the criteria are calculated using equation 10.

$$w_j = \frac{d_j}{\sum_{j=1}^{n} d_j} \quad (10)$$

MABAC METHOD

The MABAC method is an MCDM method that determines the best alternatives by obtaining the closest solutions to the ideal solution by considering criteria consisting of both qualitative and quantitative data. It is said that this method gives more consistent results than methods used in the evaluation of alternatives such as COPRAS, MOORA, VIKOR, and TOPSIS (Pamucar and Cırovic, 2015).

The steps of the method are as follows (Kılıç Delice, 2020):

1. Step: Creating the Initial Decision Matrix

The decision matrix is created as follows, where m is the number of alternatives and n is the number of criteria.

$$X_{ij} = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{21} & \dots & X_{2n} \\ \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots \\ X_{m1} & X_{m2} & \dots & X_{mn} \end{bmatrix} \quad i = 1,2,\dots,m\,; j = 1,2,\dots,n$$

It expresses the value of the i. alternative according to the j. criterion. x_{ij}

2. Step: Normalize the Initial Decision Matrix

The decision matrix created in step 1 is normalized using equation 11 for benefit criteria and equation 12 for cost criteria. The normalized decision matrix is created as follows.

$$n_{ij} = \frac{x_{ij} - x_j^-}{x_j^+ - x_j^-} \tag{11}$$

$$n_{ij} = \frac{x_{ij} - x_j^+}{x_j^- - x_j^+} \tag{12}$$

$$N = \begin{bmatrix} n_{11} & n_{12} & \dots & n_{1n} \\ n_{21} & n_{21} & \dots & n_{2n} \\ \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots \\ n_{m1} & n_{m2} & \dots & n_{mn} \end{bmatrix}$$

3. Step: Creating the Weighted Decision Matrix

Weighted decision matrix elements are calculated by substituting the previously determined criterion weights and the elements in the normalized matrix into equation 13.

$$v_{ij} = w_j(n_{ij} + 1) \tag{13}$$

4. Step: Creating the Boundary Proximity Area Matrix

The boundary proximity area value for each criterion is calculated using equation 14. Then, the boundary proximity area matrix (G) is created as follows.

$$g_j = (\prod_{i=1}^{m} v_{ij})^{1/m} \quad (14)$$

$$G = [g_1 \quad g_2 \quad \cdots \quad g_n]$$

5. Step: Calculating the Distances of the Alternatives from the Boundary Proximity Area

The distances of the alternatives from the boundary proximity area are calculated by subtracting the boundary proximity area matrix from the weighted decision matrix. This matrix is as follows.

$$Q = \begin{bmatrix} q_{11} & q_{12} & \cdots & q_{1n} \\ q_{21} & q_{21} & \cdots & q_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots \\ q_{m1} & q_{m2} & \cdots & q_{mn} \end{bmatrix}$$

$$A_i \in \begin{cases} G^+ ise\ q_{ij} > 0 \\ G\ ise\ q_{ij} = 0 \\ G^- ise\ q_{ij} < 0 \end{cases}$$

Here, A_i if G^- the alternative is in the upper proximity area, this alternative is equal to or close to the ideal alternative, G^+ if it is in the lower proximity area, this alternative is equal to or close to the non-ideal alternative. A_i for the alternative to be the best alternative, most of the criteria G^+must be in the field.

6. Step: Ranking the Alternatives

The criterion function value (S_i) for each alternative is calculated using equation 15. These values are then S_i sorted from largest to smallest. The alternative with the largest S_i value is determined as the best alternative.

$$S_i = \sum_{i=1}^{n} q_{ij}\,, i = 1,2,\ldots,m; j = 1,2,\ldots,n \quad (15)$$

FINDINGS

Accounting-based indicators used in the research,

- C1: Return on Assets Ratio (ROA),
- C2: Return on Equity Ratio (ROE),
- C3: Earnings Per Share (EPS).

Market-based indicators are:

- C4: Market Value/Book Value (MV/DD),
- C5: Tobin's Q Value,
- C6: Price Earnings Ratio (P/E) is determined as.

Within the scope of the research findings, indicator weights were calculated as follows.

According to the DEMATEL method, accounting and market-based indicators were grouped separately and the opinions of 9 academicians who are experts in their fields were taken and the prepared direct relationship matrix is given in Table 2.

Table 2: Direct Relationship Matrix

	C1	**C2**	**C3**	**C4**	**C5**	**C6**
C1	0.00	1.78	1.89			
C2	2.11	0.00	1.89			
C3	1.89	1.56	0.00			
C4				0.00	2.44	2.44
C5				1.89	0.00	1.89
C6				2.11	1.78	0.00

The variables that affect and are affected by each other among accounting and market-based variables are listed in Table3.

Table 3: Affecting and Affected Variables

	Di	**RJ**	**Di+Rj**	**Di-Rj**	**Impact Group**
C1	12,065	12,790	24,855	-0.725	Affecting
C2	12,818	11,311	24,130	1,507	Affecting
C3	11,543	12,325	23,869	-0.782	Affected
C4	-11,600	-10,225	-21,825	-1,375	Affecting
C5	-9,843	-10,556	-20,399	0.713	Affected
C6	-10,085	-10,747	-20,832	0.662	Affected

Variable weights using Equations (5) and (6) are given in Table 4.

Table 4: Indicator Weights

	C1	**C2**	**C3**	**C4**	**C5**	**C6**
W_j	0.340	0.331	0.327	0.346	0.323	0.330

In Table 3, according to the DEMATEL method, the ranking of the accounting-based indicators from the most important to the least important is determined as C1 (ROA) with a weight of 0.340, C2 (ROE) with a weight of 0.331 and C3 (HBK) with a weight of 0.327. The ranking of the market-based indicators from the most important to the least important is determined as C4 (PD/DD) with a weight of 0.346, C6 (F/K) with a weight of 0.330 and C5 (Tobin's Q) with a weight of 0.323.

For the ENTROPY method, accounting and market-based indicators are grouped separately and the decision matrix is given in Table 5.

Table 5: Decision Matrix

	C1	C2	C3	C4	C5	C6
ARDYZ	19.10	26.23	2.52	2.24	1.90	10.34
ARENA	2.46	18.38	2.29	2.09	1.14	13.77
ATATP	8.62	12.30	1.16	9.26	6.62	84.06
AZTEC	10.06	21.07	2.85	6.75	3.50	36.04
EDATA	8.63	12.22	0.48	3.66	2.91	33.62
ESCOM	22.09	22.48	5.66	1.36	1.36	7.22
FONET	18.59	22.76	1.03	1.18	1.17	6.16
HTTBT	9.62	11.18	1.04	4.85	4.33	54.94
INDEX	2.94	15.23	0.68	1.21	1.03	8.80
KFEIN	9.45	14.76	4.42	1.71	1.37	13.22
LINK	1.42	1.66	0.25	13.83	11.77	822.64
LOGO	2.54	5.97	1.40	3.05	1.77	52.76
MANAS	4.82	8.54	0.48	1.00	1.00	14.96
MIATK	25.37	31.89	1.02	8.81	7.32	35.38
MTRKS	27.09	36.11	3.66	4.09	3.44	13.79
ODIEN	23.61	51.52	2.26	6.79	0.49	56.94
PATEK	4.39	32.32	0.23	14.69	0.73	348.63
PENTA	3.15	9.76	0.50	2.78	1.56	36.17
REEDR	15.59	23.06	0.92	3.79	3.03	23.56
SMART	15.14	19.92	1.41	3.43	2.86	20.26
VBTYZ	8.31	19.88	3.87	5.30	3.83	30.42

The realized values for the criteria considered for 21 companies are given in Table 4. Accordingly, the entropy value (E_j), differentiation value (d_j) and criterion weights (W_j) obtained after the calculations are given in Table 6.

Table 6: Entropy Value, Differentiation Value and Criteria Weights

	C1	C2	C3	C4	C5	C6
E_j	0.915	0.945	0.856	0.887	0.854	0.626
d_j	0.085	0.055	0.144	0.113	0.146	0.374
$\boldsymbol{W_j}$	0.299	0.192	0.508	0.179	0.230	0.590

In Table 5, according to the ENTROPY method, the ranking of accounting-based indicators from the most important to the least important is determined as C3 (HBK) with a weight of 0.508, C1 (ROA) with a weight of 0.299 and C2 (ROE) with a weight of 0.192. The ranking of market-based indicators from the most important to the least important is determined as C6 (F/K) with a weight of 0.590, C5 (Tobin's Q) with a weight of 0.230 and C4 (PD/DD) with a weight of 0.179.

The decision matrix to be used in the MABAC method is the same as the decision matrix created in Table 4 by grouping the accounting and market-based indicators separately for the entropy method. A normalized decision matrix is created according to this matrix. After the normalized decision matrix is created, separate weighted decision matrices are created using the weights obtained in the DEMATEL and ENTROPY methods. Then, the criterion function value (S_i) is calculated and the ranking of the alternatives is calculated according to the accounting and market-based indicators as in Table 7.

Table 7: Criterion Function Value and Ranking of Alternatives According to MABAC Method

	DEMATEL WEIGHTED				ENTROPY WEIGHTED			
	Accounting Based		Market Based		Accounting Based		Market Based	
	S_i	Rank	S_i	Rank	S_i	Rank	S_i	Rank
ARDYZ	0.211	5	-0.104	15	0.154	5	-0.121	15
ARENA	-0.077	12	-0.128	16	-0.078	15	-0.161	17
ATATP	-0.103	14	0.231	3	-0.067	13	0.290	2
AZTEC	0.076	9	0.060	5	0.039	11	0.055	6

EDATA	-0.145	16	-0.031	11	-0.090	16	-0.030	10
ESCOM	0.415	3	-0.142	18	0.278	3	-0.166	18
FONET	0.091	8	-0.152	19	0.085	6	-0.180	19
HTTBT	-0.105	15	0.048	6	-0.064	12	0.078	5
INDEX	-0.188	17	-0.155	20	-0.138	17	-0.185	20
KFEIN	0.121	6	-0.131	17	0.060	7	-0.156	16
LINK	-0.325	21	0.803	1	-0.222	21	1,096	1
LOGO	-0.212	18	-0.071	13	-0.155	19	-0.088	12
MANAS	-0.220	19	-0.158	21	-0.148	18	-0.186	21
MIATK	0.241	4	0.220	4	0.199	4	0.288	3
MTRKS	0.451	1	-0.014	8	0.323	1	-0.008	8
ODIEN	0.423	2	-0.018	9	0.295	2	-0.090	13
PATEK	-0.082	13	0.299	2	-0.070	14	0.238	4
PENTA	-0.233	20	-0.090	14	-0.162	20	-0.114	14
REEDR	0.046	11	-0.029	10	0.048	9	-0.028	9
SMART	0.049	10	-0.044	12	0.047	10	-0.045	11
VBTYZ	0.106	7	0.033	7	0.048	8	0.044	7

According to the DEMATEL-MABAC method, the ranking of the companies is as follows: MTRKS is ranked 1st, ODINE is ranked 2nd, ESKOM is ranked 3rd, LINK is ranked 21st, PENTA is ranked 20th, and MANAS is ranked 19th. According to market-based indicators: LINK is ranked 1st, PATEK is ranked 2nd, ATATP is ranked 3rd, MANAS is ranked 21st, INDES is ranked 20th, and FONET is ranked 19th.

According to the ENTROPY-MABAC method, the ranking of the companies is as follows: ESCOM is ranked 1st, MTRKS is ranked 2nd, ODINE is ranked 3rd, LINK is ranked 21st, PENTA is ranked 20th, and MANAS is ranked 19th. According to market-based indicators: LINK is ranked 1st, PATEK is ranked 2nd, ATATP is ranked 3rd, FONET is ranked 21st, INDES is ranked 20th, and MANAS is ranked 19th.

The rank correlation of the rankings made separately according to the DEMATEL-MABAC and ENTROPY-MABAC methods was subjected to Spearman Rank Correlation analysis and the results in Table 8 were obtained.

Table 8: Correlation Analysis

		DEMATEL-MABAC		ENTROPY-MABAC	
		Accounting Based	**Market Based**	**Accounting Based**	**Market Based**
DEMATEL-MABAC	**Accounting Based**	1,000	0.010	0.977 **	-0.040
	Market Based	0.010	1,000	0.006	0.981 **
ENTROPY-MABAC	**Accounting Based**	0.977	0.006	1,000	-0.030
	Market Based	-0.040	0.981 **	-0.030	1,000

When Table 7 is examined, it is determined that there is a very strong same-way relationship (0.977) between the rankings calculated with the DEMATEL-MABAC and the ENTROPY-MABAC methods according to accounting-based indicators, and a very strong same-way relationship (0.981) between the rankings calculated with the DEMATEL-MABAC and the ENTROPY-MABAC methods according to market-based indicators . On the other hand, it is determined that there is no relationship between the rankings calculated with the DEMATEL-MABAC method according to accounting and market-based indicators (0.010), and there is no relationship between the rankings calculated with the ENTROPY-MABAC method according to accounting and market-based indicators (-0.030).

CONCLUSION

The evaluation of financial performance with multi-dimensional and analytical methods has become a critical need for today's businesses to maintain their sustainable competitive power. Uncertainty in market fluctuations, investor sensitivity and developments in financial reporting processes have made it necessary for companies to be evaluated not only with past financial results but also with indicators based on market perception and future expectations. In this context, accounting and market-based

performance measures offer companies two separate approaches that complement each other but are based on different data sources. In summary, while accounting-based measures evaluate the operating performance of companies using past financial statements, market-based measures are more fluid and represent the company's perceived market value and investors' expectations. Therefore, assessing both perspectives together will provide more comprehensive and reliable financial performance results. However, it can be perceived that there are relatively few studies in literature that assess the two approaches in one study and combine data obtained from different perspectives. The results of the study undertaken to rectify this gap in the literature are given below.

The research findings show that the importance levels of financial performance indicators could vary with the calculation method. When considering accounting-based indicators, EPS was ranked as the most important criterion according to the ENTROPY method, and ROA according to the ENTROPY results in the DEMATEL method. This finding is consistent with findings of studies by De Wet (2013), Putra and Kindangen (2016), Singh et al. (2024) identifying EPS and ROA as two strong indicators in indicating financial success. The ranking of ROE as second after EPS and ROA is consistent with findings of studies by Ahsan (2012) and Erawati et al. (2022), indicating the importance of shareholder returns and efficiency of capital in terms of firm valuation.

When it comes to market-based metrics, the indicator ranking of the ENTROPY and DEMATEL method led to the Price/Earnings Ratio (P/E) and Market Value/Book Value Ratio (MV/BV) being the highest ranked indicators. This result indicates that market-based metrics could hold different degrees of significance according to the investor point in time and this position could differ from expert evaluation and based on financial statements / market data. As documented in research by Brigham and Houston in 2019 and Ross et al. in 2019, these metrics show investors' perceptions of the firm's capacity to earn profits in future periods.

It is revealed through rankings based on the MABAC method companies financial performance, that the companies that ranked highest in terms of performance on accounting-based criteria were ESCOM, MTRKS and ODINE; and ranked highest based on market-based criteria were LINK, PATEK and ATATP. These results suggest that rankings can change based on the criterion used to assess companies financial performance. In addition, the studies of Şenol and Ulutaş (2018) and Tudose et al. (2022) also include evaluations supporting this difference. In addition, the results of the Spearman rank correlation analysis revealed that there is no significant relationship between the ranking based on accounting-based criteria and the ranking based on market-based criteria. However, it was determined that the rankings made according to the data obtained from the financial statements based on accounting-based indicators and the opinions received from experts are highly correlated. Similarly, it was determined that the rankings made based on market-based indicators are highly correlated. It can be said that the structural difference between the nature of market-based indicators reflecting instant market reactions and the fact that accounting-based indicators provide historical information is effective in the emergence of this result. Şenol & Ulutaş, (2018) and Tudose et al., (2022) similarly stated in their studies that market-based criteria are more sensitive to investor and market expectations, while accounting-based indicators reflect the operational efficiency and past performance of the company. In addition, this result shows that different data sources can produce different strategic results and that analyses should be made in a multi-faceted manner within this framework. Otherwise, conducting financial performance analyses focusing on only one data source or perspective may lead to misleading results. Therefore, evaluating both accounting-based and market-based indicators together can yield more accurate and holistic results. In addition, using decision-maker opinions and objective data together can provide a more consistent financial performance assessment by providing methodological diversity.

Within the framework of the results obtained, some strategic policy recommendations can be developed for companies to achieve sustainable

improvement in their financial performance and to make healthier decisions. In this context, companies with low rates in accounting-based performance indicators should review their processes to increase resource utilization efficiency and put forward strategies that balance operational costs and investment return. Similarly, companies with low market-based performance values should increase investor confidence by strengthening processes such as communication, transparency and investor relations to strategically manage investor perception. Companies should update their strategic goals in line with their needs by identifying their strengths and weaknesses and increasing their sustainable competitive power. Finally, the use of artificial intelligence-based decision support systems can be expanded to increase objectivity in financial analysis processes and decision-making mechanisms.

REFERANCES

Afonina, A. (2015). Strategic performance management: A balanced scorecard approach in the Czech Republic. Procedia Economics and Finance, 25, 18–27. https://doi.org/10.1016/S2212-5671(15)00706-1

Ahsan, A. F. M. M. (2012). Can Return on Equity be Used to Predict Portfolio Performance? Economics, Management, and Financial Markets, 7(2), 132–148.

Akçakanat, Ö., Eren, H., Aksoy, E., & Ömürbek, V. (2017). Bankacılık sektöründe ENTROPI ve WASPAS yöntemleri ile performans değerlendirmesi. *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, *22*(2), 285-300.

Amelia, R. (2024). The Effect of Return on Asset, Debt to Equity Ratio, Current Ratio and Debt to Asset Ratio on Return on Equity: Case Study on S ector Companies Transportation and Logistics Listed on the IDX. Jurnal Ilmiah Akuntansi Kesatuan, 12(5), 811-824.

Aminah, L. S. (2021). The Effect of Current Ratio, Net Profit Margin, And Return on Assets on Stock Return:(Study on Food and Beverages Companies Listed on the Indonesia Stock Exchange 2015-2017 Period). *Journal of Management, Accounting, General Finance and International Economic Issues*, *1*(1), 1-9. https://doi.org/10.55047/marginal.v1i1.8

An, H. J., & Kim, W. K. (2019). A case study on the influence factors of financial performance of Korean automotive parts cooperation companies through research hypothesis. *The Journal of Asian Finance, Economics and Business*, *6*(3), 327–337. https://doi.org/10.13106/jafeb.2019.vol6.no3.327.

Angela, I., & Nuryani, Y. (2024). Pengaruh Current Ratio dan Debt to Equity Ratio terhadap Return on Assets pada PT Ciputra Development Tbk Periode 2013-2022. Cakrawala: Jurnal Ekonomi, Manajemen dan Bisnis, 1(1), 70-78.

Arslan, R. (2020). ENTROPY Yöntemi, İçinde H. Bircan (Ed.), *Çok Kriterli Karar Verme Problemlerinde Kriter Ağırlıklandırma Yöntemleri*, 1. Baskı, 19-35, Ankara: Nobel Akademik Yayıncılık.

Asri, M. H. (2018). Analisis Rasio Dengan Variabel Eps (Earning Per Share), Roa (Return on Assets), Roe (Return on Equity), Bopo (Biaya Operasional Pendapatan Operasional) Terhadap Harga Saham Perusahaan Perbankan. Jurnal Ilmiah Ekonomi Bisnis, 22(3).

Astuti, E. P., Hermawati, R., & Handayani, R. (2023). Pengaruh Capital Adequacy Ratio dan Loan to Deposit Ratio Terhadap Return on Asset Pada PT Bank Mandiri. *Scientific Journal of Reflection: Economic, Accounting, Management and Business*, *6*(1), 143-150.

Brigham, E. F., & Houston, J. F. (2019). Fundamentals of financial management. (Fifteenth edition), Cengage Learning.

Bustani, B., Kurniaty, K., & Widyanti, R. (2021). The effect of earning per share, price to book value, dividend payout ratio, and net profit margin on the stock price in Indonesia stock exchange. Jurnal Maksipreneur: Manajemen, Koperasi, dan Entrepreneurship, 11(1), 1-18.

Cahyaningrum, Y. W., & Antikasari, T. W. (2017). Pengaruh Earning Per Share, Price to Book Value, Return on Asset, Dan Return on Equity Terhadap Perubahan Harga Saham Sektor Keuangan Tahun 2010-2014. In Prosiding Seminar Pendidikan Ekonomi dan Bisnis (Vol. 3, No. 1).

Cao, D., Lorenzoni, G., & Walentin, K. (2019). Financial frictions, investment, and Tobin'sq. Journal of Monetary Economics, 103, 105-122.

Chancharat, N., & Kumpamool, C. (2022). Working capital management, board structure and Tobin's q ratio of Thai listed firms. Managerial Finance, 48(4), 541-556.

Clout, V. J., & Willett, R. (2016). Analysing the market–book value relation in large Australian and US firms: implications for fundamental analysis and the market–book ratio. Accounting & Finance, 56(4), 1017-1040.

Colline, F. (2022). The Mediating Effect of Debt Equity Ratio on The Effect of current ratio, return on equity and total asset turnover on price to book value. Jurnal Keuangan dan Perbankan, 26(1), 75-90.

Cvetkoska, V. and Eftimov, L. (2021). Bibliometric analysis for performance measurement in business, management and accounting subject area. *Journal of Engineering Management and Competitiveness (JEMC)*, 11(1), 51-63.

Dakhlallh, M. M., Rashid, N., Abdullah, W. A. W., & Al Shehab, H. J. (2020). Audit committee and Tobin's Q as a measure of firm performance among Jordanian companies. Jour of Adv Research in Dynamical & Control Systems, 12(1), 28-41.

De Wet, J. H. v H. 2013. Earnings per share as a measure of financial performance: does it obscure more than it reveals? Corporate Ownership & Control, 10(4): 265-275

Elta, N. (2025). The Effect of Return on Equity and Dividend Payout Ratio on Price Earnings Ratio in Food and Beverage Sub-Sector Companies Listed on the Indonesian Stock Exchange In 2017-2022. Azzukhruf: Journal of Accounting and Finance, 1(1), 39-51.

Erawati, D., Shenurti, E., & Kholifah, S. N. (2022). Analisis return on asset (ROA), return on equity (ROE) dan corporate social responsibility (CSR) yang mempengaruhi nilai perusahaan pada perusahaan manufaktur. *Jurnal Akuntansi Dan Manajemen*, *19*(01), 01-10.

Eş, A., & Eğilmez, G. (2024, Eylül). Bütünleşik Entropy-CoCoSo Yöntemi ile G20 Ülkelerinin Lojistik Performans Endekslerinin Değerlendirilmesi, İçinde *Bütünleşik Çok Kriterli Karar Verme Yöntemleri ve Güncel Uygulamaları*, 105-125, Gaziantep: Özgür Yayınları.

Fu, L., Singhal, R., & Parkash, M. (2016). Tobin's q ratio and firm performance. International research journal of applied finance, 7(4), 1-10.

Gharaibeh, A. T., Saleh, M. H., Jawabreh, O., & Ali, B. J. (2022). An empirical study of the relationship between earnings per share, net income, and stock price. Appl. Math, 16(5), 673-679.

Haste, H. (2020). DEMATEL Yöntemi, İçinde H. Bircan (Ed.), *Çok Kriterli Karar Verme Problemlerinde Kriter Ağırlıklandırma Yöntemleri*, 1. Baskı, 77-95, Ankara: Nobel Akademik Yayıncılık.

Herciu, M., and Ogrean, C. (2013). Evaluation of firms financial performance and competitiveness: Evidences for automotive industry. In *Financial Management of Firms and Financial Institutions-Ostrava. 9th International Scientific Conference Proceedings, PTS I-III* (pp. 234-241). Hill.

Hojdik, J. (2020). Measuring financial performance of companies in the Visegrad Group using economic value added and selected traditional performance indicators. Journal of International Studies, 13(1), 259–272. https://doi.org/10.14254/2071-8330.2020/13-1/17

Ishaq, M., Islam, Y., & Ghouse, G. (2021). Tobin's Q as an indicator of firm performance: Empirical evidence from manufacturing sector firms of Pakistan. International Journal of Economics and Business Administration, IX, 1, 425-441.

Ittner, C.D. and Larcker, D.F. (1998), "Innovations in performance measurement: trends and research implications", Journal of Management Accounting Research, Vol. 10, p. 205.

Jabery, A., Inanloo, M. (2017). Ratio of Market Value to Book Value of Equity and Liquidity Ratios. Academic Journal of Accounting and Economic Researches, 6 (2), 80-84.

Kartiko, N. D., & Rachmi, I. F. (2021). Pengaruh Net Profit Margin, Return on Asset, Return on Equity, dan Earning Per Share Terhadap Harga Saham di Masa Pandemi Covid-19 (Studi Empiris Pada Perusahaan Publik Sektor Pertambangan di Bursa Efek Indonesia). *Jurnal Riset Bisnis Dan Investasi*, *7*(2), 58-68.

Kasaya, E. N., & Maniagi, G. M. (2020). Effect of price earnings ratio on share price volatility of firms listed on Nairobi Securities Exchange. The Strategic Journal of Business & Change Management, 7(3), 1444-1453.

Kılıç Delice, E. (2020). MABAC Yöntem ve M-Diyet Uygulamalarının Kullanılabilirlik Açısından Değerlendirilmesi, İçinde M. Kabak & Y. Çınar (Ed.), *Çok Kriterli Karar Verme Yöntemleri: MS Excel Çözümlü Uygulamalar*, 1. Baskı, 247-262, Ankara: Nobel Akademik Yayıncılık.

Kotane, I., and Kuzmina-Merlino, I. (2012). Assessment of Fınancial Indicators for Evaluation of Business Performance. *European Integration Studies*, (6).

Kumar, P. (2017). Impact of earning per share and price earnings ratio on market price of share: a study on auto sector in India. International Journal of Research, 5(2), 113-118.

Kuniawan, E. R., Arifati, R., & Andini, R. (2016). Pengaruh Cash Position, Debt Equity Ratio, Return on Asset, Current Ratio, Firm Size, Price Earning Ratio, Dan Total Assets Turn Over Terhadap Deviden Payout Ratio Pada Perusahaan Manufaktur Periode 2007-2014. Journal Of Accounting, 2(2).

Kurniasari, R. (2017). Analisis Return on Assets (ROA) dan Return on Equity Terhadap Rasio Permodalan (Capital Adequacy Ratio) Pada PT Bank Sinarmas Tbk. *Moneter-Jurnal Akuntansi dan Keuangan*, *4*(2), 150-158.

Kusmayadi, D., Rahman, R., & Abdullah, Y. (2018). Analysis of the effect of net profit margin, price to book value, and debt to equity ratio on stock return. International Journal of Recent Scientific Research, 9(7), 28091-28095.

Lim, H.-J., & Mali, D. (2024). Does Market Performance (Tobin's Q) Have A Negative Effect on Credit Ratings? Evidence From South Korea. *Asia-Pacific Financial Markets, 31*(1), 53–80.

Liniarti, S., Nasution, R. S. A., Humaira, R., Putra, Y. E., Lubis, F. K., & Gustarina, E. R. (2025). The Effect of Profitability and Corporate Social Responsibility on the Value of Companies in State-Owned Banks Listed on the Idx. International Journal of Economics and Management, 3(01), 26-40.

Lungkang, G. O., & Rusgowanto, F. H. (2023). The Effect of Return on Assets (ROA), Debt to Assets (DAR), Earnings Per Share (EPS), Growth, and Size on Company Value in Manufacturing Companies. Applied Accounting and Management Review (AAMAR), 1(2), 01-11.

Lusiana, H. (2020). The Effect of Return on Equity (ROE) and Earning per Share (EPS) on Stock Prices In Indonesia Stock Exchange 2015-2018. Ilomata International Journal of Tax and Accounting, 1(3), 132-138.

Makhija, H., & Trivedi, P. (2021). An empirical investigation of the relationship between TSR, value-based and accounting-based performance measures. *International Journal of Productivity and Performance Management*, *70*(5), 1118-1136.

Mangantar, A. A., Mangantar, M., & Baramuli, D. N. (2020). Pengaruh return on asset, return on equity dan debt to equity ratio terhadap return saham pada subsektor food and beverage di Bursa Efek Indonesia. Jurnal EMBA: Jurnal Riset Ekonomi, Manajemen, Bisnis Dan Akuntansi, 8(1). 272-281.

Marsha, N., & Murtaqi, I. (2017). The effect of financial ratios on firm value in the food and beverage sector of the IDX. Journal of business and management, 6(2). 214-226

Martínez, F. G., Jiménez, J. D., & Matas, R. Q. S. D. L. (2024). Reevaluating Bank Price-to-Book Ratios: An In-Depth Analysis of Equity Components across Economic Cycles. Journal of Risk and Financial Management, 17(8), 1-21.

Nurhayati, Y., Juliani, G., Angrainy, Y., & Akhyari, N. (2025). Pengaruh Current Ratio, Return on Asset, Total Asset Turn Over Terhadap Nilai Perusahaan Di Perusahaan Manufaktur. Jurnal Ekonomi dan Bisnis Digital, 2(3), 1635-1652.

Pamučar, D., & Ćirović, G. (2015). The selection of transport and handling resources in logistics centers using Multi-Attributive Border Approximation area Comparison (MABAC). *Expert systems with applications*, *42*(6), 3016-3028.

Parapat, E. P. S., Maksum, A., & Torong, Z. B. (2018). Effect of Company Financial Ratio, Price Earning Ratio on Stock Return and Earning Per Share as Moderating Variables in Manufacturing Companies Listed in Indonesia Stock Exchange. International Journal of Public Budgeting, Accounting, and Finance, 1(4), 1-10.

Pelloneova, N., & Stichhauerova, E. (2019). Performance evaluation of automotive cluster member companies in the Czech Republic and Slovakia. In K. Antlova, & T. Semeradova (Eds.), *Liberec Economic Forum 2019* (pp. 310–319).

Putra, F. E. P. E., & Kindangen, P. (2016). Pengaruh return on asset (ROA), Net profit margin (NPM), dan earning per share (EPS) terhadap return saham

perusahaan makanan dan minuman yang terdaftar di Bursa Efek Indonesia (Periode 2010-2014). Jurnal EMBA: Jurnal Riset Ekonomi, Manajemen, Bisnis Dan Akuntansi, 4(3). 235-245.

Rahman, M. L., & Shamsuddin, A. (2019). Investor sentiment and the price-earnings ratio in the G7 stock markets. Pacific-Basin Finance Journal, 55, 46-62.

Rahmawati, Y., & Hadian, H. N. (2022). The influence of debt equity ratio (DER), earning per share (EPS), and price earning ratio (PER) on stock price. International Journal of Financial, Accounting, and Management, 3(4), 289-300.

Remondino, M. (2020). IT Tools and Performance Indicators: A Qualitative Overview of Managerial, Organizational, Financial Strategies within Healthcare Sector. *International Journal of Business and Management*, *15*(2), 105-122.

Riofrio, M. I. P., Granizo, G. G. U., Mayorga, M. D. L. Á. H. and Alarcón, C. H. M. (2023). Key Performance Indicators for Business Financial Perspective. *Journal of Namibian Studies: History Politics Culture*, *34*, 3917-3940.

Ross, S. A., Westerfield, R. V. and Jordan, B. D. (2019). *Essentials of Corporate Finance (11th ed.).* McGraw-

Sabbagh, O., Ab Rahman, M. N., Ismail, W. R., Hussain, W. M., & Hirwani, W. (2019). The impact of TQM practices on key performance indicators: empirical evidence from automotive dealerships. *E & M Ekonomie a Management*, *22*(1), 115–129. https://doi.org/10.15240/tul/001/2019-1-008.

Safaei Ghadikolaei, A., Khalili Esbouei, S., & Antucheviciene, J. (2014). Applying FUZZY MCDM for financial performance evaluation of Iranian companies. Technological and Economic Development of Economy, 20(2), 274–291.

Sajeetha, A. M. F., Nusaika, M. F., & Safana, M. N. F. N. (2023). An empirical study on determinants of price earnings ratio: evidence from listed food, beverage and tobacco companies in Colombo stock exchange. Asian Journal of Economics, Business and Accounting, 23(10), 32-43.

Sari, R. (2021). Analysis of the Effect of Earnings per share, Price earning ratio and Price to book value on the stock prices of state-owned enterprises. Golden Ratio of Finance Management, 1(1), 25-32.

Singh, R., Gupta, C. P., & Chaudhary, P. (2024). Defining Return on Assets (ROA) in Empirical Corporate Finance Research: A Critical Review. The Empirical Economics Letters, 23(Special Issue 1), 26–36. DOI: 10.5281/zenodo.10901886

Singh, S., Tabassum, N., Darwish, T. K., & Batsakis, G. (2018). Corporate governance and Tobin's Q as a measure of organizational performance. British journal of management, 29(1), 171-190.

Spitzer, D. R. (2007). Transforming performance measurement: Rethinking the way we measure and drive organizational success. New York: AMACOM Books.

Suardana, I. B. R., Astawa, I. N. D., & Martini, L. K. B. (2018). Influential factors towards return on assets and profit change. International journal of social sciences and humanities, 2(1), 105-116.

Supriantikasari, N., & Utami, E. S. (2019). Pengaruh return on assets, debt to equity ratio, current ratio, earning per share dan nilai tukar terhadap return saham (studi kasus pada perusahaan go public sektor barang konsumsi yang listing di Bursa Efek Indonesia Periode 2015-2017). *Jurnal Riset Akuntansi Mercu Buana*, *5*(1), 49-66.

Supriatna, A. (2025). Dampak Return on Asset dan Return on Equity terhadap Harga Saham PT Bank Mandiri Tbk Kurun Waktu 2011 Hingga 2020. *SCIENTIFIC JOURNAL OF REFLECTION: Economic, Accounting, Management and Business*, *8*(1), 128-135

Suraya, A., Rismanty, V. A., & Maya, D. E. (2024). The Influence of Earning Per Share and Dividend Per Share on the Share Price of PT Adaro Energy, Tbk for the 2013-2022 Period. Formosa Journal of Sustainable Research, 3(5), 1043-1050.

Suseno, G., Putri, E. A., Sari, N., & Meilita, W. (2024). Analysis of Tobin's Q as a Mediating Variable in the Relationship between Financial Ratios and Stock Prices. E-Jurnal Akuntansi, 34(5), 1078-1092

Şenol, Z. and Ulutaş, A. (2018). Muhasebe temelli performans ölçümleri ile piyasa temelli performans ölçümlerinin CRITIC ve ARAS yöntemleriyle değerlendirilmesi. *Finans Politik ve Ekonomik Yorumlar*, (641), 983-1002.

Tambunan, S. B. (2023). Analysis of Tobin's Q, Market to Book Value of Equity and Profitability (ROA), on Asset Growth in Property Companies on the Indonesia Stock Exchange (IDX). Ilomata International Journal of Tax and Accounting, 4(3), 374-384.

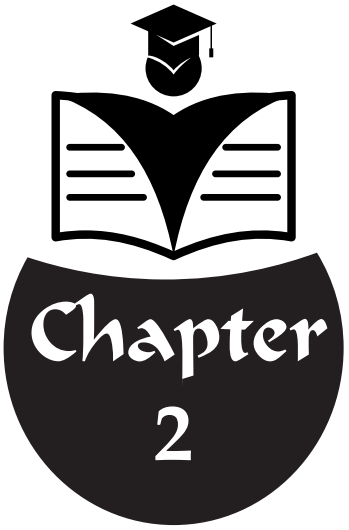
Tudose, M. B., Rusu, V. D., and Avasilcai, S. (2022). Financial performance–determinants and interdependencies between measurement indicators. *Business, Management and Economics Engineering*, *20*(1), 119-138.

Wardana, G. K. (2024). A Analysis of Factors Affecting Stock Valuation Based on Price Earning Ratio. JMK (Jurnal Manajemen dan Kewirausahaan), 9(3), 281-291.

Wijaya, R. (2019). Analisis perkembangan return on assets (ROA) dan return on equity (ROE) untuk mengukur kinerja keuangan. Jurnal Ilmu Manajemen, 9(1), 40-51.

Wu, W. W., & Lee, Y. T. (2007). Developing global managers' competencies using the fuzzy DEMATEL method. *Expert systems with applications*, *32*(2), 499-507.

Zainudin, R., Mahdzan, N. S., & Mohamad, N. N. (2021). Internationalisation and financial performance: In the case of global automotive firms. *Review of International Business and Strategy*, *31*(1), 80–102.



THE EVOLUTION AND TRANSFORMATION OF THE MARKETING MIX UNDER SUSTAINABLE STRATEGIC PARADIGMS

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1. Introduction

Global environmental challenges, the rapid depletion of natural resources, and shifting societal expectations increasingly compel businesses to reconsider their traditional marketing practices. Marketing is no longer a function solely concerned with presenting products and services for consumption; rather, it has evolved into a multidimensional responsibility area that encompasses environmental, economic, and social considerations. At the core of this transition lie sustainable strategies that organizations adopt to gain competitive advantage, maintain stakeholder trust, and secure long-term continuity.

The marketing perspective shaped by sustainable strategies has driven a significant transformation within the marketing mix. Although the classic 4P framework has for decades served as the foundational model for marketing activities, it has become insufficient to meet the expectations of today's consumers. Modern consumers no longer focus exclusively on product quality; they increasingly identify as environmentally conscious individuals who prioritize ethical production and incorporate sustainability criteria into their purchasing decisions. This shift necessitates a reinterpretation of the marketing mix that is customer-oriented, value-based, and environmentally responsible.

Today, the sustainable marketing mix is understood as a comprehensive approach requiring businesses to integrate environmental and social considerations into all dimensions of their operations- from product design and pricing to distribution systems and communication strategies. This perspective not only improves a business's economic performance but also strengthens stakeholder relationships and contributes to broader societal responsibilities.

This section explores how the marketing mix has evolved under the influence of sustainable strategies, the practices organizations have implemented throughout this transformation, and the ways in which emerging marketing paradigms align with sustainable development goals. The restructuring of the marketing mix in line with changing consumer profiles, heightened environmental awareness, and increasingly diversified stakeholder expectations represents a critical requirement for organizations seeking to remain competitive in the future.

2. Transformation of the Marketing Mix: The Limits of the 4P Model

The 4P model has long functioned as one of the foundational pillars of marketing theory, reflecting the production-oriented economic logic of its era and providing firms with a structured managerial framework. However, as sustainability-oriented transformations become increasingly prominent, it is clear that the model is no longer capable of addressing the complexities of contemporary marketing, either in scope or in substance. The assumptions

embedded within the 4P framework position the consumer as a passive recipient and presume that firms can shape market dynamics solely through controllable variables (Kotler & Keller, 2016). Yet today's marketing environment can no longer sustain an approach that isolates economic exchange from its broader social and environmental consequences.

Sustainable marketing literature highlights that marketing activities extend far beyond the traditional management of product-consumer relationships; instead, they require holistic consideration of ecological limits, societal welfare, and long-term value creation (Belz & Peattie, 2012). Through the lens of sustainability, the 4P model appears both conceptually and operationally narrow. The concept of "product," for instance, is no longer confined to physical attributes but is understood as a system element that generates environmental and social impacts throughout its entire life cycle-from design and production to usage and disposal. As Peattie (2001) emphasizes, sustainable product development is not merely a tool for competitive advantage but a fundamental necessity for functioning within the Earth's limited resource boundaries. Consequently, product-related decisions must transcend the linear production–consumption perspective of the 4P model and adopt a circular, systemic approach.

Likewise, the pricing component is reinterpreted from a sustainability standpoint. While traditional pricing strategies focus primarily on cost and competition, sustainable marketing requires a more comprehensive assessment that incorporates the consumer's perceived total cost—including time, energy, trust, durability, and environmental burden (Martin & Schouten, 2012). Under this expanded view, price evolves from a purely economic variable into a multidimensional indicator closely linked to ethical, environmental, and social considerations. The distribution (place) element also experiences substantive transformation in the era of sustainability. Modern global supply chains encompass not only product delivery but also ethical labor conditions, the carbon footprint of logistics operations, and the impacts on local communities. Thus, distribution decisions extend far beyond spatial accessibility and have become key determinants of a firm's overall sustainability performance.

The most visible transformation occurs in the communication dimension. Traditional promotion strategies rely heavily on one-way persuasive messaging, whereas contemporary consumers possess heightened information access, critical awareness, and value sensitivity. Consequently, transparency, verifiability, and consistency have emerged as essential principles of sustainable marketing communication. As Ottman (2011) argues, environmental claims earn consumer trust only when substantiated by authentic practices. Otherwise, misleading or exaggerated statements may lead to greenwashing concerns, eroding corporate credibility and weakening the long-term effectiveness of marketing strategies.

Collectively, these factors underscore the limitations of the 4P model in addressing marketing realities within the context of sustainability. The framework lacks the conceptual flexibility to account for the extensive societal, environmental, and stakeholder-related impacts inherent in modern marketing activities. Contemporary marketing requires far more than the management of controllable variables; it necessitates value creation within a complex ecosystem, the sustainable management of relationships, and the assumption of ethical responsibilities. As Papadas, Avlonitis, and Carrigan (2017) note, the effectiveness of sustainable marketing depends not only on the content of the marketing mix but also on the degree to which a sustainability-oriented culture is embedded within the organization.

In the age of sustainability, the 4P model represents not simply a technical tool but an outdated mindset that modern marketing increasingly struggles to accommodate. The transformation required goes far beyond updating individual components of the model; it calls for redefining the fundamental purpose of marketing itself. The focus has shifted from the producer toward planetary boundaries, societal expectations, and sustainable value creation. Although the 4P framework retains historical significance, it no longer aligns with the multidimensional structure demanded by sustainable marketing and must therefore give way to more inclusive, stakeholder-oriented approaches.

3. From 4P to 4C: Reconfiguring the Logic of Sustainable Marketing

The 4P model, one of the classical frameworks within the marketing discipline, served for decades as the foundational intellectual structure shaping firms' approaches to the marketplace. However, the production-oriented logic that characterized the period in which the model was developed increasingly conflicts with contemporary sustainability priorities and evolving consumer expectations. The primary limitation of the 4P model is that it conceptualizes marketing activities through firm-controlled variables while positioning the consumer as a passive recipient of managerial decisions (Kotler & Keller, 2016). Sustainability, by contrast, introduces a multidimensional paradigm that obliges firms to generate not only economic value but also environmental and social value (Belz & Peattie, 2012). This shift necessitates rethinking marketing logic as a comprehensive value-creation system; accordingly, the transition from 4P to 4C represents not merely a change in operational instruments but a profound intellectual and paradigmatic transformation.

At the core of this transformation lies the movement from "firm-centric" to "consumer-centric" marketing. Lauterborn's (1990) 4C model reconceptualizes the traditional 4P components-product, price, place, and promotion- as consumer wants and needs, consumer's perceived total cost, convenience, and communication. This reorientation shifts the focus of marketing away from what the firm offers toward what the consumer values. From a sustainability

standpoint, this shift is even more critical, as sustainability positions the consumer not merely as a market participant but as a conscious stakeholder whose decisions entail ecological and social consequences (Sheth, Sethia, & Srinivas, 2011).

Within this context, the redefinition of value creation becomes essential for aligning marketing logic with sustainability principles. Under the traditional 4P model, value is primarily conceptualized in terms of product functionality, design, and price. In contrast, sustainable marketing views value through a broader lens that includes ecological footprint, ethical production standards, life-cycle impacts, and social benefit (Peattie & Crane, 2005). As such, it is no longer sufficient for firms to create solely economic value; they must also meet consumers' ethical expectations, respond to their demand for sustainable products, and acknowledge their sensitivity to social responsibility. As Martin and Schouten (2012) assert, sustainable marketing offers a strategic foundation that integrates the firm's economic goals with the long-term well-being of society.

Furthermore, the 4C model aligns with service-dominant logic, which posits that sustainable value is co-created through reciprocal interactions between consumers and firms rather than being produced solely by the firm. Vargo and Lusch (2004) argue that value does not reside in the product itself but emerges through the processes and experiences shaped by consumers. Under this paradigm, the consumer is not a passive actor in answering the question "for whom do we create value?" but becomes an active co-creator of value. As Papadas, Avlonitis, and Carrigan (2017) emphasize, the effectiveness of sustainable marketing depends not only on operational capabilities but also on the extent to which sustainability is integrated into the organizational culture.

Thus, the shift from 4P to 4C within the context of sustainable marketing is far from a simple model update; it represents a paradigmatic transformation that redefines the meaning, purpose, and scope of marketing responsibilities. Through the 4C approach, marketing evolves beyond a firm-centered value-generation mechanism and becomes an ethical and strategic domain in which shared value for the environment, society, and consumers is jointly created. In this way, the logic of sustainable marketing transforms consumer-centricity from a theoretical principle into a practical roadmap that permeates all levels of organizational strategic decision-making.

4. Sustainable Marketing Mix: Components of the 4C Model

Sustainable marketing represents a new paradigm in which value creation is approached holistically- integrating consumer welfare, societal benefit, and environmental stewardship rather than limiting itself to economic outcomes alone. This paradigm marks a departure from the firm-centered orientation

of the traditional 4P model and underscores the need for the 4C framework, which positions the consumer at the center of the value-creation ecosystem (Lauterborn, 1990). In this consumer-driven and sustainability-aligned perspective, marketing becomes a collaborative system in which businesses co-create value with stakeholders while simultaneously addressing ecological and societal imperatives.

Unlike the 4P model, which emphasizes managerial control over product, price, place, and promotion, the 4C model reframes these elements in terms of consumer needs and experiences- namely customer value, customer cost, customer communication, and customer convenience. This reconceptualization aligns marketing with contemporary expectations of responsibility, transparency, and long-term value creation. Moreover, the 4C framework resonates strongly with sustainability principles by shifting the focus from transactional exchanges to relational, participatory, and impact-oriented processes.

In essence, the 4C model is not merely an alternative to the 4P structure; it constitutes a strategic and philosophical transformation that reflects the evolving role of marketing within society. By centering the consumer and broadening the definition of value, it enables firms to internalize sustainability considerations in a more systematic and meaningful manner. Accordingly, the four components of the 4C model collectively form the intellectual foundation of sustainable marketing, guiding firms toward practices that create shared and enduring value for consumers, businesses, and the broader environment. The following subsections examine each component of the sustainable marketing mix in detail, discussing how these elements integrate with modern consumer behavior, ethical expectations, and increasing environmental awareness.

4.1. Customer Value

In sustainable marketing, customer value is not confined to the functional attributes of a product; rather, it encompasses ethical production processes, environmental impacts, product durability, and the broader societal value proposition (Belz & Peattie, 2012). The modern consumer cares not only about what they purchase but also about what they support through their consumption choices, meaning that value perception now emerges through environmental and social criteria. In this context, Patagonia's "Don't Buy This Jacket" campaign serves as a striking example. Instead of encouraging consumption, the brand promoted reduction, repair, and circular use, offering customers not just a product but an ethical stance. This approach aligns with Peattie and Crane's (2005) assertion that sustainable value is formed through economic, environmental, and cultural layers simultaneously. Thus, sustainable customer value has become a multi-layered concept that includes not only functional benefit but also emotional and cultural dimensions such as identity, responsibility, and ethical alignment.

4.2. Customer Cost

Within the 4C logic, price is not merely a numerical monetary figure; instead, it represents the sum of the financial, psychological, environmental, and time-related costs a consumer incurs to acquire and use a product (Martin & Schouten, 2012). For this reason, sustainable marketing treats cost not as a simple "payment," but as a broader "life burden." Electric vehicles exemplify this notion well. Despite high upfront purchase prices, their lower maintenance expenses, energy efficiency, carbon-reduction benefits, and government incentives collectively reduce the total cost of ownership. This aligns with Sheth, Sethia, and Srinivas's (2011) perspective on "conscious consumption," in which consumers focus less on immediate financial cost and more on environmental responsibility and long-term benefits. Consequently, the redefinition of cost in sustainable products offers a more comprehensive framework that incorporates not only rational evaluations but also ethical and emotional considerations.

4.3. Customer Communication

In sustainable marketing, communication extends far beyond traditional promotional activities; it is a strategic process grounded in transparency, verifiability, and mutual interaction (Ottman, 2011). Today's consumers actively investigate the accuracy of environmental claims, demand clear information from brands, and critically evaluate companies' societal positions. Therefore, communication becomes not just a message but the sustainable foundation of the brand–consumer relationship. IKEA's annual sustainability reports illustrate this well, as they openly share environmental goals and performance outcomes, thereby reinforcing consumer trust. This approach reflects a strategic communication style that incorporates Peattie and Crane's (2005) warnings about greenwashing and uses transparency as a tool for risk management. Thus, sustainable communication is rooted not in persuasion, but in building trust, creating meaning, and co-producing value.

4.4. Customer Convenience

Convenience plays a critical role in enabling sustainable behavior in practice. Even when consumers wish to choose sustainable products, behavior change does not occur if these products lack accessibility, practicality, or ease of use (Charter & Polonsky, 1999). For this reason, convenience represents the point where sustainable marketing meets consumer behavior. Amazon's "Frustration-Free Packaging" program offers a useful example. The program ensures that products reach consumers with less packaging, recyclable materials, and packaging that is easier to open. In doing so, it creates a strong alignment between environmental benefit and user experience. Similarly, Starbucks' initiative that allows customers to buy beverages using their own reusable tumblers is a convenient practice that integrates sustainable behavior

into everyday routines. Hence, convenience acts as a systemic facilitator that supports sustainable consumption and allows all other C's to become functionally effective in practice.

5. Strategic Implications for Businesses

For businesses, sustainable marketing is not merely a contemporary marketing approach but a strategic necessity that determines long-term competitive strength. The consumer-centered perspective introduced by the 4C model fundamentally transforms firms' value-creation logic and positions marketing as a multidimensional governance tool encompassing economic, environmental, and social dimensions. In this regard, the meaning of the sustainable marketing mix for businesses extends beyond operational adjustments and signals the holistic restructuring of corporate strategy (Belz & Peattie, 2012). First and foremost, the expansion of customer value within the sustainability framework provides firms with a new source of competitive advantage. Modern consumers now prioritize not only the functional performance of products but also criteria such as environmental sensitivity, ethical production, societal contribution, and brand values in their purchasing decisions. Thus, the shift in value creation from functional benefit to ethical and environmental alignment contributes significantly to the development of strong brand loyalty (Peattie & Crane, 2005). The growing consumer-level reputation of businesses such as Patagonia, IKEA, and Ben & Jerry's demonstrates that sustainability has become a direct enhancer of brand equity.

Moreover, the redefinition of customer cost offers businesses new economic and operational opportunities. Evaluating sustainable products and services through the lens of total cost compels firms to invest in energy efficiency, product longevity, recyclable design, and circular processes. As Martin and Schouten (2012) note, although such investments may generate initial expenditures, they increase both customer satisfaction and long-term financial performance. Similarly, Sheth, Sethia, and Srinivas's (2011) concept of "conscious consumption" illustrates that consumers' pursuit of long-term benefits directs firms toward sustainable cost management.

The communication element of sustainable marketing also holds substantial strategic importance for businesses. Traditional, one-way, persuasion-based promotional strategies fall short of meeting the expectations of modern consumers, who carefully scrutinize environmental and social claims, seek verifiable information, and demand transparency (Ottman, 2011). As such, sustainable communication has become a critical tool for corporate reputation management. The greenwashing risks emphasized by Peattie and Crane (2005) demonstrate that firms must substantiate their sustainability claims not with rhetorical enhancement but with concrete practices. In this

context, transparent reporting, third-party certifications, and stakeholder engagement strengthen the core elements of corporate trust.

The strategic importance of convenience lies in making sustainable consumption practical and accessible in consumers' daily lives. For consumers to choose sustainable products, firms must ensure ease of access, simplified purchasing processes, and improved user experiences (Charter & Polonsky, 1999). Amazon's recyclable and minimal packaging initiatives and Starbucks' reusable cup systems provide strong examples of how convenience can become a strategic tool that facilitates sustainable behavior. Such enabling strategies strengthen the alignment between consumer behavior and corporate sustainability goals.

In conclusion, the sustainable marketing mix redefines not only how businesses position themselves in the marketplace but also their roles within broader societal and environmental systems. Sustainable marketing thus represents a powerful strategic approach that transforms firms from "value providers" into "shared value creators" (Porter & Kramer, 2011). With all these dimensions, sustainable marketing will continue to be one of the key determinants of competitive advantage, stakeholder trust, and long-term institutional resilience in the future business landscape.

6. Challenges in Implementing the Sustainable Marketing Mix

Although the sustainable marketing mix (4C) provides firms with a strong strategic framework, its practical implementation often encounters multilayered obstacles across areas such as measurement, governance, capability development, supply-chain management, communication, and behavioral acceptance. Sustainability is not merely a "value" claimed in communication; rather, it requires an organizational transformation that spans from the product life cycle to stakeholder relationships (Belz & Peattie, 2012; Papadas, Avlonitis, & Carrigan, 2017).

First, the question of what should be measured and how it should be reported constitutes a fundamental bottleneck. The environmental and social impacts that shape sustainable customer value are often multidimensional and context-dependent, making them difficult to reduce to singular metrics. Moreover, since value now emerges not from the product itself but from usage experiences and contextual interactions (Vargo & Lusch, 2004), firms must integrate LCA results, Scope 3 emissions, and social-impact indicators within the same reporting framework (Belz & Peattie, 2012). Yet such integrated measurement is frequently fragmented due to challenges in data quality, methodological alignment, and accounting practices (Papadas et al., 2017).

Related to this, organizational alignment and capability transformation emerge as critical barriers. Rather than sustainability being "owned" solely by

the marketing function, effective implementation requires integration with procurement, R&D, finance, legal, and corporate communications- something that demands deep cultural change (Papadas et al., 2017). This transformation is not limited to process updates; it also requires internalizing a new marketing logic centered on co-creation of value with the customer (Vargo & Lusch, 2004). Otherwise, the producer-centric reflexes of the 4P logic may resurface, overshadowing the customer- and stakeholder-oriented framework offered by the 4C model (Kotler & Keller, 2016).

Additionally, challenges within supply-chain and logistics operations significantly constrain the effectiveness of the sustainable marketing mix. Ensuring customer "convenience" and "accessibility" must occur simultaneously with managing distribution networks' carbon footprints, supplier compliance, and recyclable packaging (Charter & Polonsky, 1999; Belz & Peattie, 2012). Further, the reverse-logistics infrastructure required for circular business models is not equally developed across markets; differences in local infrastructure and regulatory frameworks complicate scalability (Belz & Peattie, 2012).

In the communication dimension, the most severe risk is the suspicion of greenwashing. As consumers' demand for information and expectations for verifiability increase, exaggerated or ambiguous claims lead to erosion of trust (Peattie & Crane, 2005; Ottman, 2011). Thus, effective sustainable communication requires evidence-based transparency and consistency rather than persuasive rhetoric. Claims not supported by annual reports, third-party verifications, or life-cycle data can undermine long-term brand equity (Ottman, 2011; Papadas et al., 2017). In other words, communication becomes fragile as the gap between what is "promised" and what is "actually done" grows.

Moreover, the price–value tension and the redefinition of customer cost necessitate complex negotiations in practice. Sustainable products often carry higher price tags, yet consumers tend to rationalize this difference through longevity, efficiency, and reduced externality costs (Martin & Schouten, 2012). However, willingness to pay does not form equally across all categories; income levels, cultural context, and category maturity significantly influence acceptance thresholds (Sheth, Sethia, & Srinivas, 2011). Therefore, the "total cost" narrative must be concrete and explanatory—not only addressing financial aspects but also psychological and time-related costs (Martin & Schouten, 2012).

Additionally, the convenience component must be supported through systemic solutions to facilitate sustainable behavior. Even when consumers intend to act sustainably, behavior change fails if accessible options, rapid delivery, convenient return/repair services, or reuse infrastructures are missing (Charter & Polonsky, 1999). Hence, designs that make "sustainable choices the

default" (e.g., integrating repair and reuse services into purchasing workflows) create critical impact (Belz & Peattie, 2012). Otherwise, sustainable alternatives are perceived as "extra effort," leading to habitual fallback (Sheth et al., 2011).

Finally, bridging the strategy–implementation gap requires firms to strengthen their governance structures and capability sets. Sustainable marketing demands a cross-functional operational model that brings together disciplines such as design (ecodesign), data (impact metrics), legal (compliance and claim management), communication (evidence-based narratives), and procurement (responsible sourcing) (Papadas et al., 2017; Belz & Peattie, 2012). Organizations that fail to develop these capabilities risk confining sustainability to the level of isolated "campaigns." Yet current literature shows that when integrated into corporate culture and business models, sustainability generates both competitive advantage and reputational capital (Porter & Kramer, 2011; Belz & Peattie, 2012).

In summary, the challenges in implementing the sustainable marketing mix are interconnected and systemic—ranging from measurement and reporting to organizational alignment; from supply-chain maturity to trust-building communication; from price–value negotiations to convenience infrastructures. Therefore, the solution lies not in isolated tools but in an integrated roadmap that activates all four Cs simultaneously, supported by cultural and capability transformation (Papadas et al., 2017; Vargo & Lusch, 2004).

7. Conclusion and Recommendations

Sustainable marketing is no longer a temporary trend of the contemporary business landscape; it has become a fundamental strategic requirement for organizations seeking to ensure their long-term viability. As demonstrated throughout this study, the evolution of the marketing mix from the traditional 4P framework to the 4C approach signifies a profound shift in marketing logic—one that transforms every dimension of marketing practice. Modern consumers no longer evaluate products solely based on their functional attributes; instead, they increasingly assess how products are produced, what values they represent, and what environmental and social impacts they carry. Consequently, sustainable value creation has emerged as a multidimensional framework in which economic performance, environmental responsibility, and societal contribution are managed simultaneously.

The components of the sustainable marketing mix-customer value, customer cost, communication, and convenience-require firms to transition from being mere providers of goods and services to responsible organizations that co-create value with their stakeholders. Each component directly interacts with contemporary consumer dynamics, including environmental awareness, ethical sensitivity, and heightened social consciousness. As such, sustainable marketing not only redefines the firm's role within society but also establishes

stronger foundations for deeper, longer-term relationships between brands and consumers.

Despite its strategic importance, the implementation of sustainable marketing presents several challenges. Measurement difficulties, supply-chain complexities, organizational misalignment, and resistance embedded in consumer habits may hinder firms' efforts to achieve sustainability objectives. In addition, as sustainability-related claims become more widespread, superficial or misleading communication practices pose increasing risks by undermining consumer trust. For this reason, sustainable marketing cannot be treated as a rhetorical extension of brand messaging; rather, it must be embedded as a core principle within corporate structures and business models.

Aligned with the opportunities and strategic imperatives outlined in this study, several recommendations can support the effective implementation of sustainable marketing. The conclusions presented here highlight the necessity of integrated transformation at both the organizational and operational levels. Accordingly, the following recommendations aim to enhance the practical applicability of the sustainable marketing mix and strengthen long-term value-creation processes within businesses.

First, cultivating a strong organizational sustainability culture is essential. Embedding sustainability merely into marketing activities is insufficient; all departments-from strategic decision-making to day-to-day operations-must align with sustainability principles. Encouraging employee involvement and fostering internal awareness will help integrate sustainability into the organizational identity. Moreover, firms must adopt transparent, reliable, and continuous communication strategies to build stakeholder trust and validate their sustainability commitments. Regular reporting, verifiable performance indicators, and open communication channels will enhance the credibility of environmental and social initiatives.

Second, recognizing that sustainable value creation extends beyond production, businesses must invest in circular business models and sustainable supply-chain practices. Reducing waste and resource consumption throughout the product life cycle depends on supply chains that are ethical, transparent, and environmentally responsible. Importantly, such practices are increasingly becoming sources of competitive advantage.

Third, the successful implementation of sustainable marketing requires a long-term orientation in both decision-making and performance evaluation. Traditional marketing metrics-often centered on short-term financial outcomes-are insufficient for capturing the multidimensional value embedded in sustainability initiatives. Organizations should therefore adopt broader assessment frameworks and sustainability-based KPIs (e.g., carbon intensity, product circularity, ethical-sourcing compliance, community value metrics)

that evaluate environmental outcomes, stakeholder engagement, and social impact alongside profitability. This long-term lens also improves organizational resilience in the face of regulatory shifts, market disruptions, and evolving consumer expectations.

Fourth, firms should strengthen collaboration with external stakeholders-including suppliers, regulators, NGOs, and local communities-to enhance the legitimacy and effectiveness of their sustainability strategies. Multi-stakeholder partnerships provide access to knowledge, resources, and innovation pathways that individual firms cannot easily develop alone, especially when addressing complex systems-level challenges such as climate change, resource scarcity, and social inequality. Integrating stakeholder perspectives into product design, communication strategies, and supply-chain governance elevates transparency and accountability while reinforcing the capacity to co-create shared value.

Fifth, the effectiveness of sustainable marketing depends heavily on active consumer participation. Firms should develop co-creation initiatives that enhance consumer engagement-such as feedback platforms, collaborative product improvement processes, and community-building efforts. These strategies not only strengthen sustainability awareness but also deepen brand–consumer relationships.

Finally, promoting sustainable consumption at scale requires accessible and practical infrastructures and services. Facilitating repair, reuse, recycling, and sustainable packaging-and making these options convenient, visible, and rewarding-will help consumers integrate environmentally responsible choices into their everyday routines, thereby accelerating behavioral change.

References

Belz, F.-M., & Peattie, K. (2012). *Sustainability marketing: A global perspective* (2nd ed.). Wiley.

Charter, M., & Polonsky, M. J. (Eds.). (1999). *Greener marketing: A global perspective on greening marketing practice*. Greenleaf.

Grunig, J. E., & Hunt, T. (1984). *Managing public relations*. Holt, Rinehart and Winston.

Kotler, P., & Keller, K. L. (2016). *Marketing management* (15th ed.). Pearson.

Kotler, P., Kartajaya, H., & Setiawan, I. (2017). *Marketing 4.0: Moving from traditional to digital*. Wiley.

Lauterborn, R. (1990). New marketing litany: Four Ps passé; C-words take over. *Advertising Age*, 61(41), 26.

Martin, D. M., & Schouten, J. (2012). *Sustainable marketing*. Pearson.

Ottman, J. A. (2011). *The new rules of green marketing: Strategies, tools, and inspiration for sustainable branding*. Berrett-Koehler.

Papadas, K. K., Avlonitis, G. J., & Carrigan, M. (2017). Green marketing orientation: Conceptualization, scale development and validation. *Journal of Business Research,* 80, 236-246. https://doi.org/10.1016/j.jbusres.2017.05.024.

Peattie, K. (2001). Towards sustainability: The third age of green marketing. *The Marketing Review,* 2 (2), 129-46. https://doi.org/10.1362/1469347012569869.

Peattie, K., & Crane, A. (2005). Green marketing: Legend, myth, farce or prophesy? *Qualitative Market Research: An International Journal,* 8 (4), 357-370. https://doi.org/10.1108/ 13522750510619733.

Porter, M. E., & Kramer, M. R. (2011). Creating shared value. *Harvard Business Review, 89* (1-2), 62-77.

Sheth, J. N., Sethia, N. K., & Srinivas, S. (2011). Mindful consumption: A customer-centric approach to sustainability. *Journal of the Academy of Marketing Science,* 39 (1), 21-39. https://doi.org/10.1007/s11747-010-0216-3.

UNEP. (2005). *Talk the walk: Advancing sustainable lifestyles through marketing communication*. UNEP Publications.

Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing,* 68 (1), 1-17. https://doi.org/10.1509/jmkg.68.1.1.24036.

Chapter 3

MILITARY POWER RANKING OF COUNTRIES ACCORDING TO THE MILITARY POWER INDEX*

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1. Introduction

The concept of defense occupies a fundamental position in international relations, security policies, and military strategies. Defense encompasses a set of policies, strategies, and practices designed to protect a state against external threats. Its primary objective is to safeguard a country's sovereignty, territorial integrity, national interests, and the security of its citizens. Defense involves the processes by which a state develops and maintains the capacity to protect itself, addressing both internal and external threats.

The notions of defense and security are multidimensional, with military power being a central component. Effective defense relies on the strategic deployment of military capabilities, including the army, navy, air force, and other armed forces. Critical elements such as military technology, logistics, training, and strategic planning shape and sustain military power (Maciejewski, 2019). Military power is guided by state policies and can be employed during peacetime, crises, conflicts, or wars. Its most essential function is deterrence, which underpins the survival and security of the state. According to Oran (2009, pp. 31–32), the principal aim of the state is to "realize national security externally in the broadest sense to ensure the survival of the nation."

Defense is a core element in international relations, as a state's capacity to counter external threats is the foundation of national security. It is a complex concept, encompassing military, political, economic, and social dimensions, and its role and significance in international relations are continuously evolving. Defense is also central to security policy and essential for understanding the complexities of global interactions.

Military expenditures represent the financial resources allocated by a state to secure its defense capabilities. These expenditures are shaped by multiple factors and involve intricate decision-making processes. Security threats, including terrorism, armed conflicts, cyber-attacks, and other risks, significantly influence defense budgets. Economic capacity is another critical

determinant, as states with robust economies can afford higher defense spending, whereas those facing economic constraints may need to limit expenditures. Such limitations can affect key aspects ranging from import-export capabilities to research and development (Mesjasz, 2008, pp. 140–149).

International relations also play a crucial role in shaping military spending. Alliances, security partnerships, and international agreements can either constrain or augment defense budgets. Economic power is instrumental in establishing a state as a regional or global power, both in terms of soft and hard power (Jordaan, 2003, p. 166). Strategic industries often constitute the backbone of a nation's economy, and the competitiveness of firms in these sectors directly influences national economic and defense capacities. For instance, the U.S. space industry is inextricably linked to its status as a global power (Gilpin, 2016). Consequently, careful planning and monitoring of military expenditures are vital for national security (Nelson & Silberberg, 1987, p. 20).

The Military Power Index (MPI) is a comprehensive tool frequently employed in military analyses and international relations research. Introduced as an independent initiative in the early 2000s, the MPI has gained recognition as an objective and consistent measure of military capability. Although not affiliated with any government or international organization, it evaluates military power as a multidimensional construct, incorporating factors such as manpower, air power, land power, naval power, natural resources, logistics, financial strength, and geography.

Manpower encompasses all military personnel, including active-duty and reserve forces across the army, navy, air force, and marine corps. The quantity and quality of personnel critically impact military effectiveness, as a professional, well-trained, and motivated force enhances operational capacity and overall defense capability (Ünsal, 2010).

Air power is assessed based on the number and type of fixed-wing aircraft, including fighter jets, transport planes, reconnaissance aircraft, and

helicopters. Air forces play a decisive role in achieving strategic superiority, contributing to reconnaissance, surveillance, air defense, transport, and offensive operations (Mitchell, 2010).

Ground forces are evaluated according to the number and type of tanks and armored vehicles in a country's inventory. These units are essential for land-based operations, as armored vehicles provide battlefield mobility, firepower, and protection, while tanks enable penetration of enemy defenses and facilitate rapid advances (Tucker, 2004).

Naval capabilities are measured by the quantity and type of naval vessels, including aircraft carriers, submarines, destroyers, and patrol boats. Naval forces, particularly strategically positioned ships and submarines, conduct missions such as coastal defense, maritime trade protection, control of sea lanes, logistical support, and amphibious operations, thereby enhancing a state's defense and strategic influence (Oyewole & Duyile, 2021).

Effective military operations require robust logistics, encompassing fuel production, transportation infrastructure, and supply chains. Proper logistical support ensures the sustained operational capacity of military units through the movement of personnel, equipment, supplies, and maintenance services (Kane, 2012).

Economic capacity is another key determinant of military strength. The MPI considers GDP, defense budgets, and industrial capacity to assess a state's ability to sustain military operations. A strong economy enhances a country's capacity to finance defense expenditures, procure advanced weaponry, support personnel, and develop long-term defense strategies and technologies (Dumas, 1990; Gilpin, 2016).

Geography also plays a critical role in shaping military power. Factors such as land area, coastline length, and strategic location influence defense planning, operational strategies, and the overall efficacy of military forces (Rech et al., 2015).

2. Literature review

The literature contains numerous studies on the Entropy weighting method and TOPSIS, both of which are widely used in multi-criteria decision-making (MCDM) problems. This review, however, focuses specifically on studies that examine the defense industry and related multi-criteria decision-making applications.

Özdemir (2008), in his study *"Power in International Relations: A Multidimensional Evaluation"*, conducted a literature review and descriptive analysis to explore the contexts of the "hard power/soft power" debate. He proposed a multidimensional approach to power that evaluates various contexts, practices, and consequences of power collectively.

Balcı and Çelik (2019), in *"Turkey's Military Power in the 2000s: An Assessment for Measurement Methods"*, presented alternative methods to measure Turkey's evolving military capacity during the 2000s. Their study employed the Composite Index of National Capability (CINC), which considers GDP, military expenditure, and military expenditure relative to GDP, alongside the Defense Industry Indigenization Rate.

Calap (2019), in *"Historical Character of the Balance of Power and its Adaptation to the Crimean War of 1853–1856"*, aimed to delineate the geopolitical, sociological, and historical boundaries of the balance of power system as an international system. This study employed literature research and qualitative analysis methods.

Erkmen (2019), in *"Armed Forces; Armies, Paramilitary Structures, Private Military Companies"*, evaluated armies, paramilitary structures, and private military companies, which have become prominent topics in international relations and security studies, through literature review and descriptive inference.

Altın, Tunca, and Ömürbek (2020), in *"Ranking of NATO Countries' Military Forces with Entropy-Based SAW and ARAS Methods"*, assessed the military capabilities of 27 NATO countries using entropy-based SAW and ARAS methods, comparing the results with rankings provided by the Global Firepower website.

Yıldız (2020), in *"The Balance of Military Power in the Persian Gulf"*, examined the distribution of military power among Persian Gulf countries using literature review and descriptive analysis.

Altın (2021), in *"Clustering the Military Powers of Countries Using a CRITIC-Based K-Means Algorithm"*, identified 21 criteria for 138 countries based on the Global Firepower database (2019). Criteria weights were calculated, and countries were grouped into four clusters using the K-means algorithm, with each cluster subsequently evaluated.

Öztürk and Gökbay (2022), in *"Comparative Evaluation of National Power Factors with TOPSIS and VIKOR Methods"*, analyzed national power using the MCDM methods TOPSIS and VIKOR. Their study also compared the outputs of the two methods and examined the impact of objective versus subjective weighting coefficients on the resulting rankings.

Atan, Öksüzkaya, and Atan (2023), in *"Ranking of Countries According to Their Military Power with Entropy-Based COPRAS Method"*, ranked 145 countries based on military power using data from the Global Firepower database, employing the entropy-based COPRAS method.

Putra, Waluyo, and Suharsih (2024), in *"Causality of Military Expenditure with Economic Growth in Developed and Developing Countries with the Strongest Military Power Based on Global Firepower for the Period 1978 – 2022"*, analyzed the direction of causal relationships between military expenditure and economic growth in both developed and developing countries with the strongest military capabilities, using Global Firepower data for the period 1978 – 2022.

3. Materials and Methods

In the decision-making process, conflicts between different objectives may arise. When analyzing such processes, priorities and objectives can often be in conflict with one another. Multi-criteria decision-making (MCDM) methods have been developed to address these situations, allowing the consideration of multiple objectives simultaneously. This approach enables decision-makers to identify the most advantageous options. In this study, criteria weights were calculated using the Entropy method, and countries were subsequently ranked according to their military power using the TOPSIS method.

This section first introduces the Entropy method, which is used to determine criteria weights, followed by a description of the TOPSIS method, which ranks countries based on military power indicators.

3.1. Entropy Method

The Entropy method is an objective weighting technique that considers system information and the uncertainty of criteria to determine appropriate weight values (Wang et al., 2009). Entropy, originally defined by Rudolf Clausius in the context of the second law of thermodynamics, is a measure of disorder, increasing as uncertainty rises (Zhang et al., 2011). In information theory, Shannon introduced the concept of information entropy, which quantifies uncertainty (Shannon, 1948).

The Entropy method involves the following steps:

Step 1: Construct a decision matrix containing m alternatives and n criteria:

$$\begin{bmatrix} X_{11} & X_{12} & \cdots & X_{ij} & \cdots & X_{1n} \\ X_{21} & X_{22} & \cdots & X_{2j} & \cdots & X_{2n} \\ \vdots & & \ddots & \vdots & & \\ X_{i1} & X_{i2} & & X_{ij} & \cdots & X_{in} \\ \vdots & \vdots & \cdots & \vdots & & \vdots \\ X_{m1} & X_{m2} & & X_{mj} & \cdots & X_{mn} \end{bmatrix}_{mxn} \quad \text{or } X = [X_{ij}]_{mxn} \tag{1}$$

Step 2: Normalize the decision matrix using:

$$n_{ij} = \frac{X_{ij}}{\sum_{i=1}^{m} X_{ij}} \quad i = 1,2,\dots.,m \;\; and \;\; j = 1,2,\dots,n \tag{2}$$

Step 3: Calculate the entropy values:

$$e_j = \frac{-1}{ln\, m} \sum_{i=1}^{m} n_{ij}\, ln\, n_{ij} \quad i = 1,2,\dots.,m \;\; and \;\; j = 1,2,\dots,n \tag{3}$$

Step 4: Determine the entropy-based weights:

$$w_j = \frac{1-e_{ij}}{\sum_{j=1}^{n}(1-e_{ij})} \quad i = 1,2,\dots.,m \;\; and \;\; j = 1,2,\dots,n \tag{4}$$

$$\sum_{j=1}^{n} w_j = 1$$

These weights reflect the relative importance of each criterion in the decision-making process.

3.2. TOPSIS Method

TOPSIS (Technique for Order Preference by Similarity to Ideal Solution), developed by Hwang and Yoon (1981), is a widely used MCDM method. It is based on the principle that the preferred alternative is the one closest to the positive ideal solution and farthest from the negative ideal solution (Li et al., 2011). TOPSIS allows for a comprehensive comparison of alternatives and provides a clear ranking (Zeleny, 1982). The method has been refined and extended by subsequent studies, including Yoon (1987) and Lai, Liu, and Hwang (1994).

The steps of the TOPSIS method are as follows:

Step 1: Construct an $m \times n$ decision matrix X_{ij} , where rows represent alternatives and columns represent criteria.

$$X_{ij} = \begin{bmatrix} X_{11} & X_{12} & \cdots & X_{1n} \\ X_{21} & X_{22} & \cdots & X_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ X_{m1} & X_{m2} & \cdots & X_{mn} \end{bmatrix}_{mxn} \quad (5)$$

Step 2: Normalize the decision matrix:

$$r_{\mathrm{ij}} = \frac{x_{\mathrm{ij}}}{\sqrt{\sum_{\mathrm{i}=1}^{m} x_{\mathrm{ij}}^2}}, (i = 1, 2, \ldots, m;\ j = 1, 2, \ldots, n) \quad (6)$$

Step 3: Multiply each normalized value by its corresponding criteria weight to obtain the weighted normalized matrix:

$$V_{ij} = w_j\, x\, r_{ij}\ (i = 1, 2, \ldots, m;\ j = 1, 2, \ldots, n) \text{ and } \sum_{\mathrm{j}=1}^{n} w_{ij} = 1 \quad (7)$$

$$V_{ij} = \begin{bmatrix} w_1 r_{11} & w_2 r_{12} & \cdots & w_n r_{1n} \\ w_2 r_{21} & w_2 r_{22} & \cdots & w_n r_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ w_1 r_{m1} & w_2 r_{m2} & \cdots & w_n r_{mn} \end{bmatrix} i = 1,2, \ldots., m \ \ and \ \ j = 1,2, \ldots, n$$

Step 4: Determine the positive ideal solution (A_i^+) and negative ideal solution (A_i^-):

$$\mathrm{A_i^+} = \{\mathrm{v_1^+}, \mathrm{v_2^+}, \ldots, \mathrm{v_n^+}\} = \{(\underset{i}{maks}\ \mathrm{v_{ij}} |\ \mathrm{j} \epsilon \mathrm{J_1}), (\underset{i}{min}\ \mathrm{v_{ij}} |\ \mathrm{j} \epsilon \mathrm{J_2}) \ \ | \mathrm{i} = 1, \ldots, \mathrm{m}\} \quad (8)$$

$$\mathrm{A_i^-} = \{\mathrm{v_1^-}, \mathrm{v_2^-}, \ldots, \mathrm{v_n^-}\} = \{(\underset{i}{min}\ \mathrm{v_{ij}} |\ \mathrm{j} \epsilon \mathrm{J_1}), (\underset{i}{maks}\ \mathrm{v_{ij}} |\ \mathrm{j} \epsilon \mathrm{J_2}) \mid \mathrm{I} = 1, \ldots, \mathrm{m}\}$$

Here J_1 represents benefit criteria and J_2 cost criteria.

Step 5: Calculate the distance of each alternative from the positive and negative ideal solutions:

$$d_i^+ = \sqrt{\sum_{\mathrm{j}=1}^{n} (v_{\mathrm{ij}} - \mathrm{v_j^+})^2}\ \ (\mathrm{i} = 1, 2, \ldots, \mathrm{m};\ \mathrm{j} = 1, 2, \ldots, \mathrm{n}) \quad (9)$$

$$d_i^- = \sqrt{\sum_{\mathrm{j}=1}^{n} (v_{\mathrm{ij}} - \mathrm{v_j^-})^2}\ \ (\mathrm{i} = 1, 2, \ldots, \mathrm{m};\ \mathrm{j} = 1, 2, \ldots, \mathrm{n}$$

Step 6: Compute the closeness coefficient [CC_i] for each alternative:

$$CC_i = \frac{d_i^-}{d_i^- + d_i^+} \ (i = 1, 2, \ldots, m) \tag{10}$$

Step 7: Rank the alternatives according to the CC values. The alternative with the highest closeness coefficient is considered the most favourable choice.

4. Illustrative Example and Results

Global Firepower, a defense analytics company based in the United States, publishes annual reports comparing 142 countries worldwide according to their relative levels of military power. The index is based on multiple internationally recognized indicators, including the technological sophistication of armies (land, air, and naval forces), national manpower, defense-related financial capacity, logistics infrastructure, combat readiness and mobility, and geographical location and conditions.

In this study, the criteria derived from Global Firepower's military power database were employed. The sub-criteria applied in the analysis are presented in **Table 1**. To determine the weights of these criteria for inclusion in the TOPSIS model, the Entropy method was applied. The dataset covers the years **2022, 2023, and 2024**.

Table 1. Criteria used in the research

ID	*Definition*	*Benefit / Cost*	*ID*	*Definition*	*Benefit / Cost*
M1	Total Population	Benefit	L1	Tanks	Benefit
M2	Available Manpower	Benefit	L2	Armoured Vehicles	Benefit
M3	Fit for service	Benefit	L3	Self-Propelled Artillery	Benefit
M4	Reaching Mill Age Annually	Cost	L4	Towed Artillery	Benefit
M5	Military Personals (est.)	Benefit	L5	Rocket Projectors	Benefit
M6	Active Personnel	Benefit	Nat1	Oil Production	Benefit
M7	Reserve	Cost	Nat2	Oil Consumption	Cost

ID	*Definition*	*Benefit / Cost*	*ID*	*Definition*	*Benefit / Cost*
M8	Personnel Paramilitary	Benefit	Nat3	Oil Proven Reserves	Benefit
A1	Total Aircraft Strengths	Benefit	N1	Total Assets	Benefit
A2	Fighters / Interceptors	Benefit	N2	Aircraft Carriers	Benefit
A3	Dedicated Attack	Benefit	N3	Helicopter Carriers	Benefit
A4	Transports	Benefit	N4	Destroyers	Benefit
A5	Trainers	Benefit	N5	Frigates	Benefit
A6	Special Mission	Benefit	N6	Corvettes	Benefit
A7	Tanker Fleet	Benefit	N7	Submarines	Benefit
A8	Helicopters	Benefit	N8	Petrol Vessels	Benefit
A9	Attack Helicopter	Benefit	N9	Mine Warfare	Benefit
F1	Defence Budget	Benefit	Log1	Labour Force	Benefit
F2	External Debt	Cost	Log2	Merchant Marine Fleet	Benefit
F3	Foreign Exchange / Gold	Benefit	Log3	Ports / Trade Terminals	Benefit
F4	Purchasing Power Parity	Benefit	Log4	Roadway Coverage	Benefit
G1	Square Land Area	Benefit	Log5	Railway Coverage	Benefit
G2	Coastline Coverage	Benefit	Log6	Airports	Benefit
G3	Dhared Borders	Benefit			
G4	Waterways (usable)	Benefit			

Source: https://www.globalfirepower.com/, Retrieved 01/06/2024

First, weights were calculated for the criteria values given in Table 1 using the Entropy method. For the year 2022, all calculation tables are presented in the study. For the years 2023 and 2024, intermediate calculations are not shown in the study, only the final weight values are tabulated.

Step 1: For 2022, the normalized values of the decision matrix were computed across all criteria. An excerpt of these results is shown in **Table 2.**

Table 2. Normalized Criteria Values Matrix (Year 2022)

Countries / Criteria	*M1*	*M2*	*M3*	*M4*	*M5*	-	-	*G3*	*G4*
Afghanistan	0,00492	0,00405	0,00291	0,00663	0,00118	.	.	0,01164	0,00198
Albania	0,00041	0,00042	0,00045	0,00052	0,00017	.	.	0,00134	0,00007
Algeria	0,00573	0,00579	0,00628	0,00587	0,00912	.	.	0,01309	0,00000
Angola	0,00442	0,00186	0,00119	0,00283	0,00229	.	.	0,01044	0,00215
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
Zambia	0,00251	0,00185	0,00134	0,00289	0,00034	.	.	0,01175	0,00421
Zimbabwe	0,00195	0,00156	0,00114	0,00262	0,00078	.	.	0,00628	0,00000

Source: Created by the author(s).

Step 2: Using the normalized values, $P_jLN(P_j)$ scores were derived, as reported in **Table 3**.

Table 3. $P_jLN(P_j)$ Values Calculated for 2022

Countries / Criteria	*M1*	*M2*	*M3*	*M4*	*M5*	-	-	*G3*	*G4*
Afghanistan	-0,0262	-0,0223	-0,0170	-0,0332	-0,0079	.	.	-0,0518	-0,0123
Albania	-0,0032	-0,0033	-0,0035	-0,0039	-0,0015	.	.	-0,0089	-0,0007
Algeria	-0,0296	-0,0298	-0,0319	-0,0302	-0,0428	.	.	-0,0568	0,0000
Angola	-0,0240	-0,0117	-0,0080	-0,0166	-0,0139	.	.	-0,0476	-0,0132
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
Zambia	-0,0150	-0,0116	-0,0089	-0,0169	-0,0027	.	.	-0,0522	-0,0230
Zimbabwe	-0,0122	-0,0101	-0,0077	-0,0156	-0,0056	.	.	-0,0318	0,0000

Source: Created by the author(s).

Step 3: Entropy values (E_j) and diversification measures (d_j) were calculated (see **Table 4**).

Table 4. Entropy (E_j) and (d_j) Values Calculated for 2022

Criteria	*M1*	*M2*	*M3*	*M4*	*M5*	-	-	*G3*	*G4*
Entropy (E_j)	0,723	0,703	0,692	0,717	0,756	.	.	0,913	0,677
d_j	0,277	0,297	0,308	0,283	0,244	.	.	0,087	0,323

Source: Created by the author(s).

The scaling constant was defined as: $k = 1 / LN(N) = 1 / LN (142) = 0.202$.

Step 4: Final weights (w_j) for each criterion were obtained using the d_j values. The results for 2022 are summarized in **Table 5**.

Table 5. Entropy Criteria Weight Values Calculated for 2022

Criteria	*M1*	*M2*	*M3*	*M4*	*M5*	-	-	*G3*	*G4*
Weight Values	0,0175	0,0187	0,0194	0,0179	0,0154	.	.	0,0055	0,0203

Source: Created by the author(s).

The procedure was replicated for 2023 and 2024, with results reported in **Table 6** and **Table 7**, respectively.

Table 6. Entropy Criteria Weight Values Calculated for 2023

Criteria	*M1*	*M2*	*M3*	*M4*	*M5*	-	-	*G3*	*G4*
Weight Values	0,0175	0,0188	0,0195	0,0180	0,0146	.	.	0,0055	0,0204

Source: Created by the author(s).

Table 7. Entropy Criteria Weight Values Calculated for 2024

Criteria	*M1*	*M2*	*M3*	*M4*	*M5*	-	-	*G3*	*G4*
Weight Values	0,0174	0,0186	0,0191	0,0176	0,0140	.	.	0,0053	0,0183

Source: Created by the author(s).

Across all three years, criterion **"A7 – Tanker Fleet"** consistently had the highest weight, while **"G3 – Shared Borders"** had the lowest. At this stage of the study, the military power index of Global Firepower company for all countries of the world was ranked again with the TOPSIS method using the criteria weights calculated by the Entropy method.

The Entropy-derived weights were subsequently applied in the TOPSIS framework to re-rank the Global Firepower military index for 142 countries under 48 criteria. The process involved:

1. Constructing the decision matrix (**Table 8**).
2. Normalization of the decision matrix (**Table 9**).

3. Weighting of the normalized matrix (**Table 10**).
4. Identification of Positive Best Values (PBV) and Negative Best Values (NBV) (**Tables 11–12**).
5. Computation of positive and negative ideal distances (**Tables 13–14**).
6. Derivation of D^+, D^- and relative closeness coefficients C_i (**Table 15**).

Intermediate calculations for 2023 and 2024 were performed but are not presented here due to space constraints. Interested readers may contact the corresponding author for the full dataset.

Table 8. Decision Matrix for 2022

Countries / Criteria	***M1***	***M2***	***M3***	***M4***	***M5***	-	-	***G3***	***G4***
Afghanistan	37466414	14611901	8242611	786795	60000	.	.	5987	1200
Albania	3088385	1513309	1284768	61768	8500	.	.	691	41
Algeria	43576691	20916812	17779290	697227	465000	.	.	6734	0
Angola	33642646	6728529	3364265	336426	117000	.	.	5369	1300
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
Zambia	19077816	6677236	3796485	343401	17500	.	.	6043	2550
Zimbabwe	14829988	5635395	3218107	311430	40000	.	.	3229	0

Source: https://www.globalfirepower.com/, Accessed May 2024

Table 8 shows the decision matrix for 2022 based on forty-eight criteria and data from one hundred and forty-two countries.

Table 9. Normalized Decision Matrix for 2022

Countries / Criteria	***M1***	***M2***	***M3***	***M4***	***M5***	-	-	***G3***	***G4***
Afghanistan	0,0180	0,0140	0,0098	0,0243	0,0055	.	.	0,0966	0,0072
Albania	0,0015	0,0015	0,0015	0,0019	0,0008	.	.	0,0112	0,0002
Algeria	0,0210	0,0200	0,0211	0,0215	0,0425	.	.	0,1087	0,0000
Angola	0,0162	0,0064	0,0040	0,0104	0,0107	.	.	0,0866	0,0078
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
Zambia	0,0092	0,0064	0,0045	0,0106	0,0016	.	.	0,0975	0,0152
Zimbabwe	0,0071	0,0054	0,0038	0,0096	0,0037	.	.	0,0521	0,0000

Source: Created by the author(s).

Table 9 shows the normalized decision data for forty-eight criteria and one hundred and forty-two countries for the year 2022. All elements of the normalized decision matrix are weighted with the weight values defined in Table 4. The resulting values are shown in Table 10 below.

Table 10. Weighted Normalized Decision Matrix for 2022

Countries / Criteria	*M1*	*M2*	*M3*	*M4*	*M5*	-	-	*G3*	*G4*
Afghanistan	0,00038	0,00029	0,0002	0,00051	0,00011	.	.	0,00201	0,00015
Albania	3,00E-05	3,00E-05	3,00E-05	4,00E-05	2,00E-05	.	.	0,00023	1,00E-05
Algeria	0,00044	0,00042	0,00044	0,00045	0,00089	.	.	0,00226	0,00000
Angola	0,00034	0,00013	8,00E-05	0,00022	0,00022	.	.	0,00180	0,00016
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
Zambia	0,00019	0,00013	9,00E-05	0,00022	3,00E-05	.	.	0,00203	0,00032
Zimbabwe	0,00015	0,00011	8,00E-05	0,00020	8,00E-05	.	.	0,00109	0,00000

Source: Created by the author(s).

In Table 10, the normalized decision matrix of forty-eight criteria and one hundred and forty-two countries for 2022 is weighted with Entropy values and the results are given in Table 11.

Table 11. Positive Best Values (PBV) for 2022

Criteria	*M1*	*M2*	*M3*	*M4*	*M5*	-	-	*G3*	*G4*
PBV	0,01401	0,01505	0,01532	0,00000	0,01327	.	.	0,00755	0,01369

Source: Created by the author(s).

Table 11 shows the Positive best values for forty-eight criteria for 2022.

Table 12. Negative Best Values (NBV) for 2022

Criteria	*M1*	*M2*	*M3*	*M4*	*M5*	-	-	*G3*	*G4*
NBV	0,00000	0,00000	0,00000	0,01462	0,00000	.	.	0,00000	0,00000

Source: Created by the author(s).

Table 12 shows the Negative best values for forty-eight criteria for 2022.

Table 13. Positive Ideal Distances for 2022

Countries / Criteria	*M1*	*M2*	*M3*	*M4*	*M5*	-	-	*G3*	*G4*
Afghanistan	0,000186	0,000218	0,000229	2,60E-07	0,000173	.	.	3,07E-05	0,000183
Albania	0,000195	0,000226	0,000234	1,60E-09	0,000176	.	.	5,36E-05	0,000187
Algeria	0,000184	0,000214	0,000221	2,03E-07	0,000153	.	.	2,80E-05	0,000187
Angola	0,000187	0,000223	0,000232	4,84E-08	0,000170	.	.	3,31E-05	0,000183
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
Zambia	0,000191	0,000223	0,000232	4,84E-08	0,000175	.	.	3,05E-05	0,000179
Zimbabwe	0,000192	0,000223	0,000232	4,00E-08	0,000174	.	.	4,17E-05	0,000187

Source: Created by the author(s).

Table 13 presents the positive ideal values for forty-eight criteria and one hundred and forty-two countries for 2022.

Table 14. Negative Ideal Distances for 2022

Countries / Criteria	*M1*	*M2*	*M3*	*M4*	*M5*	-	-	*G3*	*G4*
Afghanistan	1,44E-07	8,41E-08	4,00E-08	0,000199	1,21E-08	.	.	4,04E-06	2,25E-08
Albania	9,00E-10	9,00E-10	9,00E-10	0,000213	4,00E-10	.	.	5,29E-08	1,00E-10
Algeria	1,94E-07	1,76E-07	1,94E-07	0,000201	7,92E-07	.	.	5,11E-06	0,00000
Angola	1,16E-07	1,69E-08	6,40E-09	0,000207	4,84E-08	.	.	3,24E-06	2,56E-08
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
Zambia	3,61E-08	1,69E-08	8,10E-09	0,000207	9,00E-10	.	.	4,12E-06	1,02E-07
Zimbabwe	2,25E-08	1,21E-08	6,40E-09	0,000208	6,40E-09	.	.	1,19E-06	0,00000

Source: Created by the author(s).

Table 14 shows the negative ideal values for forty-eight criteria and one hundred and forty-two countries for 2022.

Table 15. D Positive (D_i^+) Values, D Negative (D_i^-) Values and Relative Distances (C_{ij}) Values for 2022

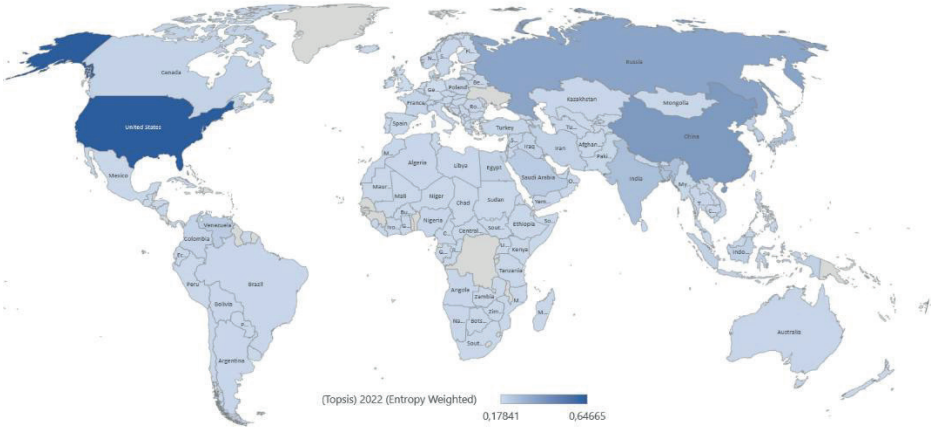
Criteria	*M1*	*M2*	*M3*	*M4*	*M5*	-	-	*G3*	*G4*
D_i^+	0,09874	0,09900	0,095	0,09731	0,09607	.	.	0,09862	0,09867
D_i^-	0,02891	0,02909	0,02918	0,02916	0,02910	.	.	0,02906	0,02902
C_{ij}	0,22648	0,22711	0,23498	0,23057	0,23248	.	.	0,22760	0,22727

Source: Created by the author(s).

Table 15 shows D Positive (D_i^+) values, D Negative (D_i^-) values and Relative distance values (C_{ij}) for forty-eight criteria for 2022.

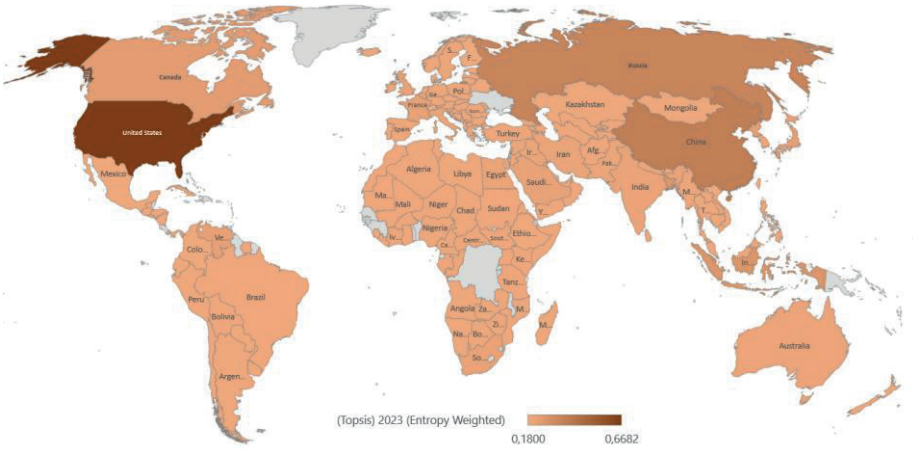
All the intermediate calculation stages given in the tables above were carried out in 2023 and 2024. Interim calculations are not presented again in this section of the study. Researchers interested in other calculations can get information about other tables and calculations from the e-mail address of the responsible author. After this stage, the rankings of countries according to their military power values are presented as maps below.

At this stage of the study, the ranking data were expressed as a map to make the rankings made using the military power score values of the countries for the years 2022, 2023 and 2024 easier to understand.



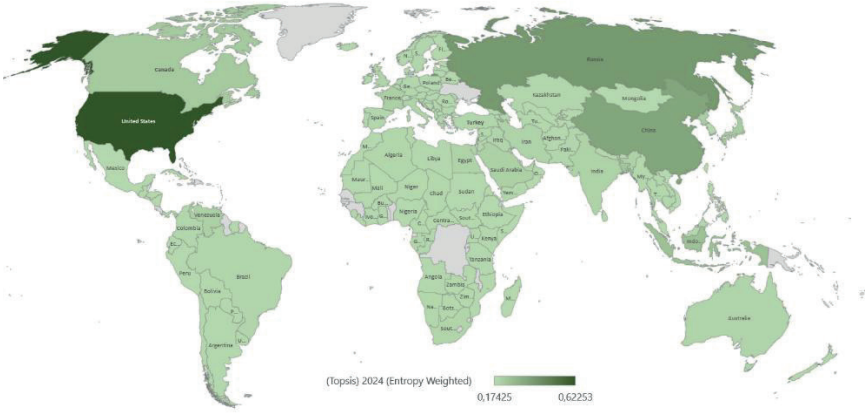
Source: Created by the author(s).

Figure 1. Entropy-weighted TOPSIS Model Country Military Power Rankings (2022)



Source: Created by the author(s).

Figure 2. Entropy-weighted TOPSIS Model Country Military Power Rankings (2023)



Source: Created by the author(s).

Figure 3. Entropy-weighted TOPSIS Model Country Military Power Rankings (2024)

The Entropy-weighted TOPSIS rankings for 2022, 2023, and 2024 were visualized in geographic map form to enhance interpretability (**Figures 1–3**).

(*Figures 1–3 here*)

- **2022 (Figure 1):** The top ten countries were the United States, China, Russia, India, Bangladesh, Japan, Saudi Arabia, Venezuela, South Korea, and Indonesia. The weakest performers were Germany, the Netherlands, Luxembourg, the United Kingdom, and Ireland.
- **2023 (Figure 2):** The leading countries were the United States, China, Russia, Indonesia, Bangladesh, Canada, North Korea, Japan, Venezuela, and France. The lowest-ranked were Switzerland, Taiwan, Sierra Leone, Vietnam, and Singapore.
- **2024 (Figure 3):** The strongest militaries were the United States, Russia, China, Indonesia, Canada, Japan, North Korea, Saudi Arabia, and Venezuela (with North Korea appearing twice due to a reporting error). The weakest were Switzerland, Taiwan, Vietnam, the Philippines, and Singapore.

Finally, the consistency between the Entropy-weighted TOPSIS results and Global Firepower's official rankings was assessed using Spearman's rank correlation. For 2024, the correlation was:

Table 16. Spearman Rho Rank Correlation for 2024

	Global Fire Power Company Rankings
Entropy-weighted TOPSIS Model Country Military Power Rankings	0,278
Significance Level (P)	0,001

Source: Created by the author(s).

This statistically significant positive correlation suggests that the Entropy-weighted TOPSIS approach provides rankings broadly aligned with Global Firepower, while offering an alternative, methodologically transparent framework for evaluating national military power.

5. Managerial Implication and Conclusions

This study applied an **Entropy-weighted TOPSIS multi-criteria decision-making (MCDM) model** to Global Firepower's military power index for 2022, 2023, and 2024. The purpose was to propose an alternative ranking framework and to analyze how variations in criterion weights,

determined objectively through the Entropy method, influence the overall ranking outcomes.

Global Firepower traditionally ranks countries by combining factors such as the size of armed forces, technological capabilities, economic strength, and geographical characteristics. These rankings provide valuable insights for understanding global power balances, supporting strategic decision-making, and planning defense operations. They can also serve as important reference points for allocating defense budgets and guiding military modernization initiatives.

The alternative rankings generated through the Entropy-weighted TOPSIS model demonstrate that applying different weighting schemes and evaluation methods can produce distinct perspectives on military power. Unlike purely numerical or size-based measures, the MCDM approach captures a more nuanced assessment that reflects the multi-dimensional nature of military capability.

From a **managerial perspective**, these findings have several implications:

- **Strategic Defense Planning:** Governments and defense institutions may use alternative ranking models to complement traditional indices, thereby gaining a broader understanding of their relative strengths and weaknesses.
- **Resource Allocation:** By identifying which criteria (e.g., naval fleet capacity, logistics, or manpower reserves) carry the most weight in alternative models, decision makers can prioritize investments more effectively.
- **International Relations:** Alternative rankings may influence diplomatic negotiations and alliance formation by offering different perspectives on comparative military power.
- **Peace and Stability:** Transparent, multi-criteria rankings can help reduce misperceptions of military strength among states, contributing to more balanced strategic policies.

In conclusion, military power rankings are not only descriptive tools but also critical instruments for understanding the complexities of international security and the balance of power. While the Global Firepower index provides a widely recognized benchmark, incorporating **alternative, methodologically**

robust approaches such as Entropy-weighted TOPSIS offers significant added value. By diversifying ranking methodologies, analysts and policymakers can obtain a more comprehensive and accurate picture of military capability, which in turn supports more effective strategy formulation, defense planning, and conflict prevention efforts.

Contributions and Limitations

This study contributes to the literature in several important ways. First, it introduces the use of an **Entropy-weighted TOPSIS framework** as an alternative to the widely cited Global Firepower index, thereby demonstrating how objective weighting methods can reshape traditional military power rankings. Second, it provides an empirical comparison across three consecutive years (2022–2024), offering a dynamic perspective on how criterion weighting influences changes in country rankings. Third, by emphasizing a **multi-dimensional view of military capability**, the study enriches the discourse in both defense economics and international relations, moving beyond conventional size- or expenditure-based metrics.

Despite these contributions, certain limitations must be acknowledged. The study relies on secondary data derived from the Global Firepower index, which, while comprehensive, may not fully capture qualitative aspects of military effectiveness such as training quality, morale, or strategic doctrine. In addition, the scope of analysis is limited to selected years, which restricts the ability to assess long-term structural changes in military power.

Future research could expand this line of inquiry in several ways. Comparative studies using alternative MCDM methods (e.g., VIKOR, PROMETHEE, or COPRAS) could provide deeper insights into methodological robustness. Extending the analysis to a longer time horizon or incorporating **hybrid models that combine quantitative and qualitative indicators** would further enhance validity. Finally, integrating economic, political, and technological dimensions could yield a more holistic and policy-relevant evaluation of national power.

References

Altın, F. G., (2021), Clustering The Military Powers of Countries Using Critic Based K-Means Algorithm, European Journal of Digital Economy Research, 2(1), 5 - 13.

Altın, F. G., Tunca, M. Z. & Ömürbek, N. (2020). Entropi Temelli SAW ve ARAS Yöntemleri ile NATO Ülkeleri Askeri Güçlerinin Sıralanması, Alanya Akademik Bakış, 4(3), 731 – 753.

Atan, M., Atan, S. & Öksüzkaya, M., (2023), Sosyal, Beşerî ve İktisadi Bilimlerde Uygulamalar Holistence Publication, Ranking of Countries according to their Military Power with Entropy - based COPRAS Method, Çanakkale.

Balcı A., & Çelik, C., (2019), Turkey's Military Power in the 2000s: An Assessment for Measurement Methods, Turkish Policy Quarterly, Summer 18(2), 101 – 111.

Calap, Adil, (2019), "Güç Dengesinin Tarihsel Karakteri ve 1853-56 Kırım Savaşı'na Uyarlanması", Turkish Studies - Economics, Finance, Politics, Volume 14 Issue 1, 1 – 30.

Dumas, L. J. (1990). Economic Power, Military Power, and National Security. Journal of Economic Issues, 24 (2), 653 - 661.

Erkmen, S., (2019), Silahlı Güçler; Ordular, Para-Militer Yapılar, Özel Askeri Şirketler, Güvenlik Yazıları Serisi, No. 39. https://trguvenlikportali.com/wp-content/uploads/2019/11/SilahliGuc ler_SerhatErkmen_v.1. pdf DOI:10.13 140/RG.2.2. 26888. 37121.

Gilpin, R. (2016). Uluslararası İlişkilerin Ekonomi Politiği, Kripto, 4. Edition, Ankara.

https://www.globalfirepower.com/, Access Date: 01 June 2024.

Hwang, C. L. and Yoon, K. (1981). Multiple Attribute Decision Making: Methods and Applications, a State of the Art Survey, Lecture Notes in Economics and Mathematical Systems. New York: Springer-Verlag, 129.

Jordaan, E. (2003). The Concept of a Middle Power in International Relations: Distinguishing between Emerging and Traditional Middle Powers, Politikon: South African Journal of Political Studies, 30 (1), 165 - 181.

Kane, T. M. (2012). Military Logistics and Strategic Performance. Routledge.

Lai Y. L, Liu T. Y. and Hwang C. L. (1994). TOPSIS for MODM. European Journal of Operational Research, 76, 486 - 500.

Li, H., Adeli, H., Sun, J. and Han, J. G. (2011). Hybridizing Principles of TOPSIS with Case-Based Reasoning For Business Failure Prediction. Computers and Operations Research, 38 (2), 409 – 419.

Maciejewski, J., (2019). How the British Army's Operations Went Agile. Interviewer: Rob Theunissen, Inverview Date: 12 October 2019.

Mesjasz, C. (2008). Ekonomik Güvenlik. Uluslararası İlişkiler Dergisi, 5(18), 125-150.

Mitchell, W. (2010). Winged Defense: The Development and Possibilities of Modern Air Power - Economic and Military. University of Alabama Press.

Nelson, D. & Silberberg, E., (1987). Ideology and Legislator Shirking, Economic Inquiry, Western Economic Association International, 25(1), 15-25.

Oran, B., (2009). Türk Dış Politikası. Vol. 1., Edition 15, İletişim Publications.

Oyewole, S., & Duyile, A. (2021). The Enduring Relevance of Naval Power: Reflections on Defence, Security and Power Projection of Sea Frontier. Austral: Brazilian Journal of Strategy & International Relations, 10 (20).

Özdemir, Haluk (2008). "Uluslararası İlişkilerde Güç: Çok Boyutlu Bir Değerlendirme", Ankara Üniversitesi SBF Dergisi, 63 (3), 113 - 144.

Öztürk, S. & Gokbay, I. Z., (2022) Milli Güç Faktörlerinin Topsis ve Vikor Yöntemleriyle Karşılaştırmalı Değerlendirilmesi, Duvar Yayınları, 315 - 339.

Putra, P. D., Waluyo, J.& Suharsih S., (2024), Causality of Military Expenditures with Economic Growth in Developed and Developing Countries with the Strongest Military Power Based on Global Fire Power for the Perıod 1978-2022, International Journal of Advanced Economics, 6(3), 36 – 48.

Rech, M., Bos, D., Jenkings, K. N., Williams, A., & Woodward, R. (2015). Geography, Military Geography and Critical Military Studies. Critical Military Studies, 1(1), 47 - 60.

Shannon, C.E. (1948). A Mathematical Theory of Communication, The Bell System Technical Journal, 27(3), 379 - 423

Tucker, S. C. (Ed.). (2004). Tanks: An illustrated History of Their Impact. Bloomsbury Publishing USA. U.S. Defense Spending Compared to Other Countries. Peter G. Peterson Foundation. https://www.pgpf.org/chart-archive/0053_defense-comparison.

Ünsal, S. (2010). Milli Güç, Bileşenleri ve Vasıtaları. Türk Dünyası Araştırmaları.

Yıldız, M., (2020), Basra Körfezi Askerî Güç Dengesi", Ortadoğu Araştırmaları Merkezi (ORSAM) Analiz, No: 259, Agust.

Yoon, K. (1987). A Reconciliation Among Discrete Compromise Situations. Journal of Operational Research Society, 38 (3), 277 - 286.

Zeleny M. (1982). Multiple Criteria Decision Making. New York: McGraw-Hill, 327 - 388.

Zhang, H., Gu, C., Gu, L., Zhang, Y. (2011), The Evaluation of Tourism Destination Competitiveness by TOPSIS & Information Entropy A Case in the Yangtze River Delta of China, Tourism Management, 32, 443 - 451.

Wang, J. W., Cheng, C. H. & Cheng, H. K. (2009). Fuzzy Hierarchical TOPSIS for Supplier Selection, Applied Soft Computing, 9 (1), 377 – 386.

Chapter 4

ISSUES OF COORDINATION BETWEEN BUDGET POLICY, DEBT POLICY, AND INFLATION

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INTRODUCTION

Public budget and public debt, each constituting a distinct component of public economics in its own right, either give rise to inflation or are affected by inflation during the implementation of economic policy, depending on governments' preferences. Therefore, if the interactions between these components and inflation become problematic, they lead to coordination issues and exert strong adverse effects on other instruments of fiscal policy and economic policy. Governments determine what kind of policy they will pursue regarding inflation for the next fiscal year in advance, and these preferences in fact represent critical crossroads for governments. Governments will either pursue a production-oriented policy or adopt an inflationary policy. A non-inflationary policy preference, on the other hand, is theoretically based on "zero inflation." What falls to governments at this point is to coordinate the financing policies of their treasuries with the monetary policies of their Central Banks. When governments and Central Banks pursue policies in favor of increasing production, the outcome will ultimately evolve toward "zero inflation" through policy success.

Below, the economic policies pursued by the governments of Türkiye over a period of forty-six years are briefly highlighted.

I. BUDGET POLICY

Budget surplus/deficit is also referred to in the economics literature as budget balance. The budget balance expresses the difference between total public revenues and total public expenditures. At the same time, the budget balance represents the difference between public budget revenues (money received by the state) and public budget expenditures (money paid by the state). If revenues are exactly equal to expenditures, the state has a balanced budget. If revenues exceed expenditures, there is a budget surplus, whereas if revenues are less than expenditures, there is a budget deficit. Changes in either public expenditures or tax policies affect the budget balance. If the state increases its expenditures without increasing taxes, the additional expenditure is said to be a financed deficit. If additional expenditures are accompanied by an increase in tax rates that generates an increase in revenues equal to the increase in expenditures, then we can mention a spending-balanced budget

(Lipsey et al., 1990: 618). One of the most important distinctions in modern public finance is the distinction between structural and cyclical deficits. The idea underlying this distinction is simple. The role of the budget is determined by structural or active discretionary policies, such as tax rates, social security benefits, or the size of defense spending. However, a disturbingly large part of the budget is passively determined by the state of the cyclical or conjunctural wave, that is, by the degree to which national income and national output are high or low.

In order to clarify this distinction, economists measure structural and cyclical budgets:

The real budget records expenditures, revenues, and deficits in real monetary terms for a given period.

The structural budget calculates what the state's revenues, expenditures, and deficits would be if the economy were operating at potential output.

Cyclical budgeting measures the impact of economic fluctuations on the budget by analyzing changes in revenues, expenditures, and deficits that occur as the economy operates towards its potential output, but also experiences periods of revival and stagnation.

The cyclical budget is the difference between the real budget and the structural budget.

In practice, the distinction between structural and cyclical budgets is closely related to the distinction between discretionary and automatic stabilization components. The main structural expenditures and revenues consist of discretionary programs enacted by the legislature through laws, whereas cyclical expenditures and deficits consist of taxes and expenditures that adjust automatically according to the state of the economy (Samuelson and Nordhaus, 1989: 388–389).

From the perspective of Türkiye, central government budget deficits and the reasons underlying these deficits can be summarized as follows. The central government budget deficit formed at the beginning of the fiscal year,

based on the estimation of expenditures that the relevant administrations will undertake throughout the year in relation to the total of estimated general budget revenues and estimated special budget revenues, and the central government budget deficit encountered at the end of the fiscal year represent different concepts. Even if cash needs are balanced throughout the year by using treasury resources, borrowing that cannot be covered by tax revenues as of the end of the period emerges as the real deficit. This situation reveals the existing structure and certain findings:

-The share of the total cash financing requirement related to the central government budget within GNP has been continuously increasing.

-The gap between estimated revenues and appropriations projected at the beginning of the fiscal year widens due to appropriation-increasing demands during the fiscal year. Although attempts are made to reduce this gap through "Implementation Instructions" issued by the Ministry of Finance during the year, the budget deficit, and thus the share of expenditures financed through deficits, continues to rise steadily (Altuğ, 1994: 193–194).

Public deficits, including budget deficits, have effects on the economy such as inflation, increase in interest rates, and deterioration of the balance of payments (Önder and Kirmanoğlu, 1994: 47). When the central government budget, which constitutes the largest portion of the public sector deficit in Türkiye, is taken as the criterion, the following situation emerges: taxation capacity is not fully utilized. As a result, significant deficits have emerged, especially since the mid-1980s. If taxation capacity had been fully utilized, these deficits would not have emerged, or even if deficits had occurred, they would not have been of this magnitude. Therefore, the deficits that emerged would not even have been real deficits in the true sense. Based on this, the extraordinarily large interest burden faced today cannot be regarded as the cost of compulsory deficit financing in the past. This interest burden is the burden of insufficient financing. Compensating the public sector's insufficient financing through excessive borrowing and interest burdens has led to excessive financing of the private sector or rentiers (Önder et al., 1995: 28).

In the early 1980s, an increasing number of people began to believe that large budget deficits should be reduced or eliminated due to their adverse

effects on the economy. Many were concerned that deficits (1) cause inflation, (2) raise interest rates and thereby reduce the economy's growth rate through lower investment, and (3) increase balance of payments deficits by altering the value of the currency.

When it is assumed that government purchases increase or taxes are reduced, resulting in a government budget deficit, and it is also assumed that the economy's output and employment are below the full employment level, aggregate demand increases. The level of economic activity rises regardless of the method of financing. However, the magnitude of the increase in economic activity depends on the financing method (Edgmond et al., 1996: 361–362).

As is well known, when budget revenues exceed budget expenditures, a budget surplus emerges (Lipsey et al., 1990: 37–38). In general, it is accepted that a budget surplus has a contractionary effect on the economy. If the concept of a budget surplus is examined from a more theoretical perspective, we encounter the concept of full employment budget surplus.

In an economy, full employment budget surplus can be calculated by taking the full employment level of economic activity as the basis and estimating budget expenditures and revenues at that level. In this way, the aim is to eliminate the effects that changes in the level of economic activity would have on the budget surplus. According to the full employment budget surplus criterion, if the budget shows a surplus at the full employment level, fiscal policy is described as contractionary, whereas if the budget shows a deficit at the full employment level, fiscal policy is described as expansionary (Ataç, 1994: 37–38). Within the full employment budget surplus approach, which is based on the fundamental assumption that a budget balanced at the full employment level is neutral in terms of cyclical effects, a comparison is made between a given year's actual expenditures and the revenues that could be obtained if production capacity were fully utilized under the existing tax laws, that is, under full employment conditions. Thus, the difference between the tax revenues estimated for the full employment level and actual expenditures is referred to as the full employment balance. Therefore, unlike the financing balance, for this balance to be real, full employment must actually prevail

during the budget period, meaning that the objective of cyclical policy must be achieved.

Changes or deviations in the balance over time provide information about the direction and magnitude of the budget's cyclical effects. For example, if it is observed that there is a gradually increasing (fictitious) full employment balance from year to year, it can be concluded that fiscal policy is having a contractionary effect. If this contractionary effect is undesirable, one possible measure is to increase public expenditures by using the balance as an indicator. If this increase is incorporated into the newly determined balance, the full employment budget surplus may be reduced. To avoid misunderstanding at this point, it should be emphasized that the full employment balance is not used as an indicator of influencing the capacity utilization rate in the economy through public finance. Within the full employment budget surplus approach, it is assumed that any two budgets with the same level of full employment balance have the same effect. In determining the indicator, an effort is made to provide a uniform basis for comparison by starting from state revenues that could be obtained at the full employment level. Contrary to the traditional financing balance, the aim is to establish a uniform criterion by using a fictitious balance determined at full employment as an indicator, rather than the actual balance that changes depending on cyclical developments. The point that should be noted here is that, in comparing the cyclical effects of budgets belonging to two successive periods, the relative full employment balance should be used, that is, absolute balances should be expressed as a ratio to full employment national income. The fact that absolute full employment balances may lead to misleading conclusions should not be overlooked. This is because a balance that is absolutely the same in magnitude will have a weaker effect as full employment income increases. Therefore, if the relative full employment balances of two budgets differ, the economic effects they generate will also differ in magnitude. The most significant difficulty of the full employment budget surplus approach in terms of practical application concerns the calculation of the fictitious national income that could be achieved if all factors of production were fully and efficiently utilized. The reason for this is that, in order to compare full employment tax revenues with actual expenditures,

potential national income must be determined each year (Turhan, 1990: 135–136).

After addressing the issue of the full employment budget surplus, it becomes necessary to explain a concept referred to as the fiscal drag. When tax revenues are considered as an endogenous variable related to the level of national income, two economic characteristics of taxation are encountered. One of these is the automatic stabilizing character of taxes, which will be examined. The other characteristic is the budget function discussed above, which reflects the positive relationship between tax revenues and the level of national income.

As the level of national income rises, tax revenues increase even when there is no change in the tax function, that is, even when taxes and tax rates remain unchanged. Although this situation, which is closely related to the automatic stabilizing property of taxation, may be beneficial in the short run, it can give rise to significant drawbacks in the long run. One of these drawbacks, and the most important one, is that as the economy reaches new and higher full employment levels of national income in the long run, technically speaking as the economy grows, the rapid increase in tax revenues may hinder economic growth. This drawback, referred to as the fiscal drag, arises due to the increase in budget surpluses caused by rising tax revenues and the consequent decline in investment. This is because, in order to sustain economic growth, investment must increase relative to savings by an amount equal to the difference between taxes and government expenditures, as can be recalled from the equation Savings + Taxes = Investment + Government Expenditures. If this increase in investment does not materialize, growth is either constrained or cannot be sustained.

Eliminating this fiscal drag that impedes growth requires either increasing the effectiveness of expenditure policy or reducing the effectiveness of tax policy. Another principle derived from this result is that expenditure and tax policies should be sufficiently flexible not only to resolve short-term problems but also to address long-term issues (Savaş, 1982: 232–233).

The effectiveness of the budget balance policy depends on the ratio of the budget balance magnitude to the total size of the budget in question.

TABLE 1

Years	General Budget Deficits (Million TL)	Inflation Rates (%)
1979	-60,164.0	56.8
1980	-159,324.9	115.6
1981	-96,514.3	36.8
1982	-142,729.8	25.2
1983	-219,185.3	31.4
1984	-508,292.6	52.0
1985	-513,156.8	45.0
1986	-1,157,818.3	34.6
1987	-2,346,350.9	39.0
1988	-3,858,684.9	73.7
1989	-7,502,598.6	63.9
1990	-11,781,841.7	60.3
1991	-33,316,634.7	63.8
1992	-47,328,037.4	72.3
1993	-133,105,390.0	66.1
1994	-150,838,636.9	120.6
1995	-314,943,850.0	93.6
1996	-1,233,350,043.0	80.4
1997	-2,235,153,190.3	99.1
1998	-3,803,376,481.8	69.7
1999	-9,151,619,793.0	68.8
2000	-13,264,885,674.0	39.0
2001	-29,036,094,758.0	68.5
2002	-40,090,025,519.1	29.7
2003	-39,815,859,000.0	13.9
2004	-30,443,025,000.0	9.3
2005	-6,860,970,000.0	7.72
2006	-5,768,293,000.0	9.65
2007	-14,491,205,000.0	8.39
2008	-17,871,880,000.0	10.06
2009	-53,113,016,000.0	6.53
2010	-41,322,231,000.0	6.40
2011	-18,936,234,000.0	10.45

2012	-30,412,349,000.0	6.16
2013	-19,932,921,000.0	7.40
2014	-23,305,763,000.0	8.17
2015	-25,185,380,000.0	8.81
2016	-32,853,910,000.0	8.53
2017	-49,299,964,000.0	11.92
2018	-72,573,025,000.0	20.30
2019	-126,161,691,000.0	11.84
2020	-178,145,206,000.0	36.72
2021	-206,130,949,000.0	82.81
2022	-140,276,537,000.0	137.55
2023	-1,388,502,324,000.0	127.00
2024	-2,255,037,213,000.0	83.40

Sources: The table was prepared using data from the General Directorate of Public Accounts, TURKSTAT, and the Istanbul Chamber of Commerce.

When the data presented in Table 1 are subjected to the FMDOLS estimator using the FMDOLS method, the results observed in the econometric analysis emerge.

II. DEBT POLICY

While the effects of budget deficits have been discussed, a distinction must be made between two methods of financing: treasury bills and money issuance. In order to finance the budget deficit, the treasury must borrow. It does so by selling treasury securities. These securities may be purchased by consumers, commercial banks, and firms, including other financial institutions. When this process takes place, the money supply in the economy does not change, since the funds borrowed by the treasury are immediately spent by various government agencies.

However, in the past, the securities offered for sale by the treasury could be purchased by the Central Bank. If the process operates in this manner, the money supply in the economy increases. The purchase of treasury securities by the Central Bank increases the reserves of the banking system. As system reserves increase, the money supply in the economy expands. Indeed,

if the treasury simply prints money, the sale of treasury securities to the Central Bank has the same effect on the money supply.

In short, whether or not the money supply changes depends on the method of deficit financing. If the treasury sells securities to the private sector, the money supply increases. Briefly, the first method of financing refers to financing through the issuance of treasury bills, while the second implies financing through money issuance or money creation.

The elements of the state's borrowing policy related to domestic borrowing and its economic effects were addressed in the section on state budget deficits. Here, attention will be focused solely on state external borrowing and its economic effects. In the case of external debt, the state's accumulation of sufficient funds for repayment is not a sufficient condition for payment to be made. In addition, these funds must be convertible into foreign currency accepted for debt repayment or into a freely usable means of payment. In many cases, it is observed that despite having sufficient liquidity in national currency, states are unable to fulfill their obligations to foreign creditors due to the inadequacy of external means of payment. External debt affects the level of national income. Indeed, external debt allows the borrowing country to dispose of foreign goods and services, that is, to increase the supply of goods, whereas debt repayments result in the transfer of a portion of national output abroad.

Another very important characteristic of external debt is its close connection with international political relations and, in some cases, the fact that it arises solely as a result of political considerations. Debts that arise as a result of political calculations, in other words, debts extended solely or primarily for political purposes, are also referred to as political debts. Political debts are generally owed to foreign states or state-affiliated institutions, although in some cases they may also be owed to foreign private individuals. Indeed, a foreign state may enable the acquisition of such debts from private individuals not only by lending directly through itself or its affiliated institutions, but also by influencing its own markets. This influence often manifests itself in the form of guaranteeing the contracted debt. Political external debts are generally debts that could not be obtained in the absence of

a political calculation or objective, or at least could not be obtained under the same conditions. These political calculations and objectives may vary widely. However, among them, the most influential are grand strategic political, military, and economic objectives such as securing the alliance of a country that is relatively weak economically or financially; keeping a formally allied but politically uncertain country within the alliance system for a longer period; ensuring at least its neutrality if it is likely to join opposing blocs; facilitating its ability to continue fighting and to conduct warfare more effectively when engaged in a joint war; or bringing that country within a sphere of influence.

The fact that some states that were almost unable, or able only to a very limited extent, to borrow from domestic markets, such as Russia and the Ottoman Empire before the First World War, were nevertheless able to borrow extensively from abroad can only be explained by such political considerations. However, political debts gained particular importance during the Second World War and the period that followed, reaching levels that represented the vast majority of external debts. In this respect, it is worth recalling the large credits extended by states fighting on the same side at the outbreak of the war and during the war itself, as well as the substantial loans granted after the war, primarily by the United States and other wealthy countries, first to countries that had suffered severe war damage and later to countries classified as less developed.

External debts that arise as a result of the nationalization of foreign enterprises by many countries are also essentially political in nature. This is because political considerations weigh heavily in such nationalizations, as was the case in Türkiye after the establishment of the Republic and in Egypt with respect to the Suez Canal. In this case, however, it is no longer the creditor state that pursues a political objective, but rather the state that carries out the nationalization and thus becoming the borrower. A characteristic feature of debts arising from nationalization is that they are mostly owed not to foreign states but to foreign private individuals (Yaşa, 1981: 58–59).

Before examining the effects of external debt, it is necessary to classify external debts. External debts can be examined under five categories from various perspectives.

According to their use, credits can be classified as:

-Project credits and program credits,

-Tied credits and untied credits,

-Debt rescheduling and refinancing credits.

According to their sources, credits can be classified as:

-Intergovernmental borrowing,

-Borrowing from international organizations,

-Borrowing from private sources.

According to the status of the borrowing entities, credits can be classified as:

-Public debts,

-Private debts.

According to the method of repayment, credits can be classified as:

-Debts payable in foreign currency,

-Debts payable in domestic currency.

According to maturity, credits can be classified as:

-Short-term debts,

-Medium- and long-term debts (Eker, 1994: 56–57).

The economic effects of external debt can be classified as the direct effects of external borrowing on the economy and other effects of external borrowing.

One of the direct effects of external borrowing on the economy relates to its impact on the balance of economic factors and their prices. If external borrowing is used directly for the import of goods and services, it will affect the prices of goods and services. If external borrowing is used directly as capital for investment, since there will be a relative decline in the proportions

of labor, land, and entrepreneurship in relation to capital within the existing balance of land, labor, and entrepreneurship, an upward tendency will be observed in the prices of these factors, that is, in their shares within the economy.

Another direct effect of external borrowing on the economy is the multiplier effect. The multiplier mechanism has two types of effects on the national economy, in other words, on national income. The first of these effects is the impact on income resulting from investment. The second effect is the impact on exports, again arising from investments.

Another direct effect of external borrowing on the economy concerns the impact of foreign exchange parities on the terms of trade. As a result of investments financed through external borrowing, the export-generated increase in foreign currency supply directly exceeds the increase in foreign currency demand.

From another perspective, however, the effect of debt payments and interest on the foreign trade balance will operate in the opposite direction.

Another direct effect of external borrowing on the economy is the gains derived from foreign trade as a result of the impact of external debt on the terms of trade. A shift in the terms of trade in favor of a country creates a situation similar to the outcome produced by an inflow of foreign capital from developed countries. Price increases in export goods raise the country's export revenues, thereby providing the opportunity to purchase capital goods required for national development.

Export profits obtained from high export prices accelerate the development of a country's monetary income flow. Due to this monetary income flow, national income increases. Part of this income increase is saved, while another part is spent on domestically produced goods or imported goods. In a less developed country where supply conditions do not exhibit flexibility in the short run, this leads to an increase in consumption expenditures, greater consumption of domestically produced goods and services, and ultimately rising prices. Rising prices, in turn, tend to increase imports. An improvement in the terms of trade thus creates a source of foreign

exchange earnings for poor and less developed countries. However, these foreign exchange earnings must be used for capital accumulation through appropriate measures and economic and fiscal policies.

As for the other economic effects of external borrowing, the issue must be considered from a more general perspective.

One of the other economic effects of external borrowing is its impact on economic growth. Because external borrowing leads to capital accumulation, it facilitates the realization of infrastructure investments such as roads, ports, dams, energy production facilities, as well as the establishment of health and education institutions. External borrowing also provides the foreign exchange required to meet the demand for raw materials, equipment, and spare parts imports necessary for industrial production aimed at achieving targeted development rates in less developed countries. For these reasons, it contributes to economic growth.

Another effect of external borrowing is its social impact. Since external debts facilitate the realization of fundamental social investments, they have a positive effect on improving education and health standards.

One of the other effects of external borrowing is its impact on the expansion of production capacity. As is well known, the monetary cost of external debt consists of interest and other servicing expenses. If the increase in output obtained by borrowing countries from external debt exceeds the interest and servicing costs paid, external borrowing will generate an economic benefit. Since capital accumulated through external borrowing helps provide workers with more tools, equipment, and other means of production, it increases productivity. Furthermore, the relative importance of land and other factors of production in the production process also increases. The expansion of production capacity through external debt is, in a sense, dependent on a country's capacity to absorb external debt. The capacity to absorb external debt is measured by the extent to which borrowed funds are used in productive areas. Borrowing capacity is also related to marginal benefit and marginal cost. Marginal benefit and marginal cost, in turn, depend on the productive use of borrowed capital within the country, that is, on well-prepared projects and the effective coordination of these projects through a well-designed plan. It is

natural that projects of varying levels of efficiency will be prepared depending on a country's economy, technology, and the quality of its managerial cadre. The number and scale of projects whose marginal benefits exceed their marginal costs determine borrowing capacity (Açba, 1991: 51–60).

The effectiveness of borrowing policy also depends on whether the area in which the debt is used is capable of covering debt servicing obligations.

TABLE 2

Years	**Domestic Debt (Million TL)**
1979	192,841
1980	721,000
1981	991,000
1982	1,341,000
1983	3,173,000
1984	4,634,000
1985	6,972,000
1986	10,514,000
1987	17,218,000
1988	28,458,000
1989	41,934,000
1990	60,902,000
1991	106,374,000
1992	195,237,000
1993	357,347,000
1994	799,309,000
1995	1,361,007,000
1996	3,148,984,000
1997	6,283,425,000
1998	11,612,885,000
1999	22,920,145,000
2000	36,420,620,000
2001	122,157,260,000
2002	149,869,691,000
2003	194,386,700,000
2004	224,482,922,000
2005	244,782,000,000

2006	251,470,000,000
2007	255,310,000,000
2008	274,827,296,000
2009	330,004,579,000
2010	352,841,000,000
2011	368,541,676,000
2012	386,541,676,000
2013	403,006,954,000
2014	414,648,522,000
2015	440,124,000,000
2016	468,644,000,000
2017	535,448,000,000
2018	586,142,000,000
2019	755,100,000,000
2020	1,060,400,000,000
2021	1,321,200,000,000
2022	1,905,300,000,000
2023	3,209,300,000,000
2024	6,079,600,000,000

Source: The table was prepared based on the Central Government Domestic Debt Stock Statistics of the Ministry of Treasury and Finance.

When the data in Table 2 are subjected to the FMDOLS estimator using the FMDOLS method, the outcomes observed in the econometric analysis emerge.

TABLE 3

Years	**External Debt (Million USD)**	**External Debt (Million TL)**
1979	13,439	505,306.4
1980	15,734	1,195,784
1981	16,627	1,832,295.4
1982	17,858	2,873,352.2
1983	18,814	4,214,336
1984	20,823	7,598,312.7
1985	25,660	13,299,578

1986	32,206	21,558,696.4
1987	40,326	34,506,958.2
1988	40,722	57,857,817.6
1989	43,911	93,126,448.8
1990	52,381	136,588,695.6
1991	53,623	223,602,547.7
1992	58,595	403,573,062.5
1993	70,512	774,644,832
1994	68,705	2,040,833,931.5
1995	75,948	3,468,810,978
1996	79,299	6,429,848,396.4
1997	84,356	12,773,944,724
1998	96,351	25,055,123,675.1
1999	103,123	43,324,674,122.6
2000	118,602	73,972,541,808
2001	113,592	139,196,977,185.6
2002	129,532	195,054,402,114
2003	144,097	215,146,590,776.6
2004	160,977	228,964,219,352.4
2005	169,901	227,803,260,800
2006	207,819	297,409,770,900
2007	249,553	324,793,229,500
2008	277,005	358,139,764,500
2009	268,194	414,922,937,400
2010	290,350	435,641,140,000
2011	303,909	507,528,030,000
2012	339,022	607,696,935,000
2013	389,054	7,397,083,702,000
2014	402,482	8,805,903,678,000
2015	402,700	10,953,440,000,000
2016	405,640	12,255,195,680,000
2017	450,350	16,427,416,950,000
2018	425,780	22,469,687,940,000
2019	413,850	24,565,308,300,000
2020	429,170	31,819,522,140,000
2021	437,280	58,244,384,160,000

2022	458,690	85,312,670,480,000
2023	499,880	147,052,698,880,000
2024	515,500	181,742,618,000,000

Source: The table was prepared based on the Central Government External Debt Stock Statistics of the Ministry of Treasury and Finance.

When the data in Table 3 are subjected to the FMDOLS estimator using the FMDOLS method, the outcomes observed in the econometric analysis emerge.

III. ECONOMETRIC ANALYSIS

The above data were processed and analyzed in the econometric analysis process

as described below.

III.a. Methodology

In this section of the study, the research models, the definitions of the variables used in the research models, and the econometric methods employed in the analysis are introduced. Within the scope of the study, the research models to be estimated are specified as Equations (1) through (3):

$$\mathrm{LNINF_t} = \alpha + \beta_1 \mathrm{LNDOM_t} + \varepsilon_t \quad (1)$$

$$\mathrm{LNINF_t} = \sigma + \beta_2 \mathrm{LNDEF_t} + \mu_t \quad (2)$$

$$\mathrm{LNINF_t} = \rho + \beta_3 \mathrm{LNEXT_t} + \pi_t \quad (3)$$

In these equations, the subscript t denotes the time dimension and covers 46 annual observations between 1979 and 2024 (t = 1979, 1980, …, 2024). The parameters α, σ, and ρ represent the constant terms of the equations, while ε, μ, and π denote the error terms. The coefficients β_i represent the estimated effects of the independent variables on the dependent variable (i = 1, 2, 3). The expressions LN preceding the variables indicate that the variables are expressed in logarithmic form in order to eliminate extremely large or small numerical values that would otherwise make interpretation difficult due to the magnitude of the original variables (Gujarati and Porter, 2009: 97). The

definitions of the variables included in the equation set are presented in Table 4.

Table 4. Variable Definitions

Variable	Definition	Unit
INF	Annual Inflation Rate	Per cent (%)
DOM	Domestic Debt	Million TL
DEF	Budget Deficit	Million TL
EXT	External Debt	Million TL

Since the type of data used in the study consists of time series data, the time series properties of the variables become particularly important in the analyses to be conducted. In this context, it is necessary to address the issue of spurious regression that may arise if the variables are non-stationary. To examine the stationarity properties of the variables, the ADF and PP unit root tests, which employ two different autocorrelation correction methods, were used. In addition, in order to take into account another time series characteristic, namely structural breaks, DF-type unit root tests with structural breaks were also applied, with the aim of reaching robust conclusions regarding the stationarity of the variables.

Based on the unit root test results, it was observed that all variables are non-stationary at levels but become stationary at their first differences. The non-stationarity of the variables at levels implies that coefficients obtained from OLS regressions established with these variables would be subject to the suspicion of spurious regression. For this reason, it is necessary to examine cointegration relationships among the variables prior to coefficient estimation. Since the variables were found to be stationary at the same order, cointegration relationships among the variables were examined using the Johansen cointegration test. The test developed by Johansen (1988, 1991) examines long-run relationships among variables using the maximum likelihood approach (Johansen, 1991: 1556). As a result of the Johansen cointegration test applications, it was found that all independent variables are cointegrated with the dependent variable. Given the existence of cointegration among the variables, the Fully Modified Ordinary Least Squares (FMDOLS) estimator was employed to estimate long-run coefficients. FMDOLS is an estimation

method developed to correct for autocorrelation and endogeneity problems in cointegrated series (Phillips and Hansen, 1990: 108). Finally, Granger causality analysis was used to investigate short-run causality dynamics among the variables. The Granger causality test is a type of causality analysis that examines whether one variable is affected by the past values of another variable (Granger, 1969: 429).

III.b. Results

The descriptive statistics calculated for the variables included in the research models are presented in Table 5.

Table 5: Descriptive Statistics of Variables

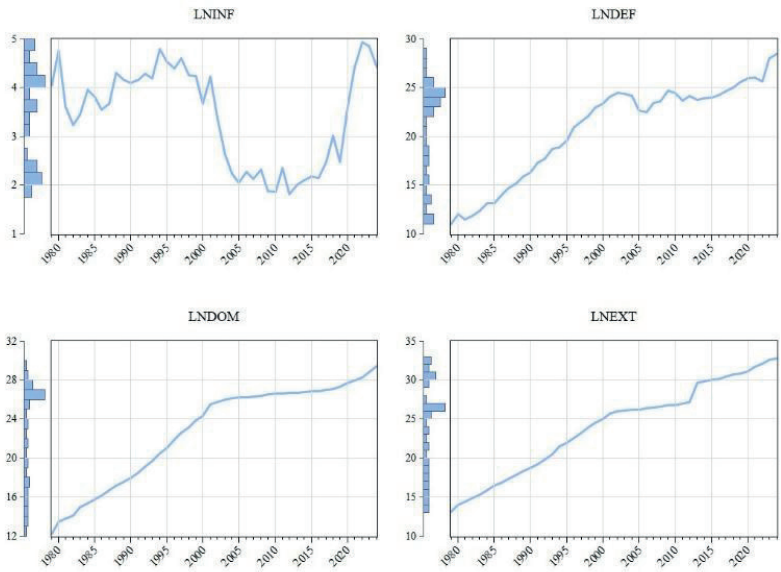
Statistic	LNINF	LNDOM	LNDEF	LNEXT
Mean	3.422	22.724	20.756	24.011
Median	3.635	25.631	23.123	25.828
Maximum	4.924	29.436	28.444	32.834
Minimum	1.818	12.170	11.005	13.133
Standard Deviation	1.009	5.090	5.020	5.824
Skewness (S)	-0.255	-0.610	-0.633	-0.286
Kurtosis (K)	1.569	1.906	2.053	1.876
Jarque-Bera	$\chi^2_{(2)}$=4.422 [0.110]	$\chi^2_{(2)}$=5.146* [0.076]	$\chi^2_{(2)}$=4.789* [0.091]	$\chi^2_{(2)}$=3.048 [0.218]
Number of Observations	46	46	46	46

* Indicates normal distribution at the 5% significance level. $\chi^2_{(S.D)}$:Chi-square test statistic with df degrees of freedom; values in square brackets indicate p-values.

The LNINF variable ranges between 1.818 and 4.924 and is normally distributed at the 10% significance level with a mean of 3.422 and a standard deviation of 1.009. ($\chi^2_{(2)}$=4.422, p>0.10). The LNDOM variable ranges between 12.170 and 29.436 and is normally distributed at the 5% significance level with a mean of 22.724 and a standard deviation of 5.090. ($\chi^2_{(2)}$=5.146, p>0.05). The LNDEF variable ranges between 11.005 and 28.444 and is normally distributed at the 5% significance level with a mean of 20.756 and a standard deviation of

5.020. ($\chi^2_{(2)}$=4.789, p>0.05). The LNEXT variable ranges between 13.133 and 32.834 and is normally distributed at the 10% significance level with a mean of 24.011 and a standard deviation of 5.824. (3.048, p>0.10). The time series variables graph are presented in Figure 1. Examination of the figures indicates that the LNINF variable does not exhibit a pronounced trend, whereas the other series display increasing trend characteristics. In terms of structural breaks, it can be stated that the LNINF and LNDEF variables exhibit structural break characteristics in both the mean and the trend, while for the LNDOM and LNEXT variables, no breaks are observed in the mean, but break periods are observed in the trend. Considering these structural break characteristics, it is deemed useful to also apply unit root tests that take structural breaks into account when examining the stationarity levels of the variables.

Figure 1: Time Series Variables Graph



The findings of the ADF and PP unit root tests are presented in Table 6.

Table 6: ADF and PP Unit Root Test Results

Variable	ADF		PP		Decision
	Constant	Constant and Trend	Constant	Constant and Trend	
LNINF	-1.440	-1.138	-1.464	-1.128	I(1)
	[0.554]	[0.911]	[0.542]	[0.913]	
ΔLNINF	-6.868***	-7.108***	-6.859***	-7.108***	
	[0.000]	[0.000]	[0.000]	[0.000]	
LNDEF	-1.340	-1.419	-1.315	-1.488	I(1)
	[0.603]	[0.842]	[0.615]	[0.819]	
ΔLNEF	-6.129***	-6.104***	-6.155***	-6.127***	
	[0.000]	[0.000]	[0.000]	[0.000]	
LNDOM	-1.165	-1.701	-2.671*	-1.411	I(1)
	[0.681]	[0.734]	[0.087]	[0.844]	
ΔLNDOM	-4.510***	-4.573***	-4.707***	-5.012***	
	[0.000]	[0.004]	[0.000]	[0.001]	
LNEXT	-1.654	-1.648	-1.626	-1.648	I(1)
	[0.448]	[0.758]	[0.461]	[0.758]	
ΔLNEXT	-6.060***	-6.162***	-6.168***	-3.368***	
	[0.000]	[0.000]	[0.000]	[0.001]	

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Δ denotes the first difference of the variable; values in square brackets indicate p-values. Optimal lag (Lag) lengths were selected according to the Schwarz Information Criterion from among a maximum of four lags.

Examination of the table shows that for all variables included in the research models, the ADF and PP unit root tests conducted under both constant and constant-and-trend specifications indicate that the variables are non-stationary at levels but become stationary at their first differences. In other words, based on the ADF and PP unit root tests, all variables are integrated of order one. The results of the unit root tests with structural breaks conducted to account for structural changes in the stationarity processes are presented in Table 7.

Table 7: Unit Root Test Results with Structural Breaks

Variable	Unit Root Specifications				Decision
	Constant	Break Specifications			
		Trend and Constant			
		Constant	Trend	Constant and Trend	
LNINF	-2.142	-3.000	-2.686	-3.459	I(1)
	[0.970]	[0.911]	[0.852]	[0.832]	
Δ LNINF	-7.470***	-7.848***	-7.420***	-7.858***	
	[0.000]	[0.000]	[0.000]	[0.000]	
LNDOM	-3.594	-3.691	-3.506	-3.097	I(1)
	[0.335]	[0.570]	[0.403]	[0.947]	
ΔLNDOM	-8.354***	-7.539***	-4.367*	-7.834***	
	[0.000]	[0.000]	[0.077]	[0.000]	
LNDEF	-2.276	-2.838	-2.889	-3.252	I(1)
	[0.951]	[0.949]	[0.762]	[0.910]	
ΔLNDEF	-7.805***	-7.805***	-6.649***	-7.855***	
	[0.000]	[0.000]	[0.000]	[0.000]	
LNEXT	-3.985	-2.858	-2.893	-3.400	I(1)
	[0.161]	[0.945]	[0.761]	[0.858]	
ΔLNEXT	-9.970***	-11.301***	-6.166***	-11.197***	
	[0.000]	[0.000]	[0.000]	[0.000]	

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Δ denotes the first difference of the variable; values in square brackets indicate p-values. Optimal lag (Lag) lengths were selected according to the Schwarz Information Criterion from among a maximum of four lags. Break dates were endogenously determined based on Dickey–Fuller minimum t-statistics.

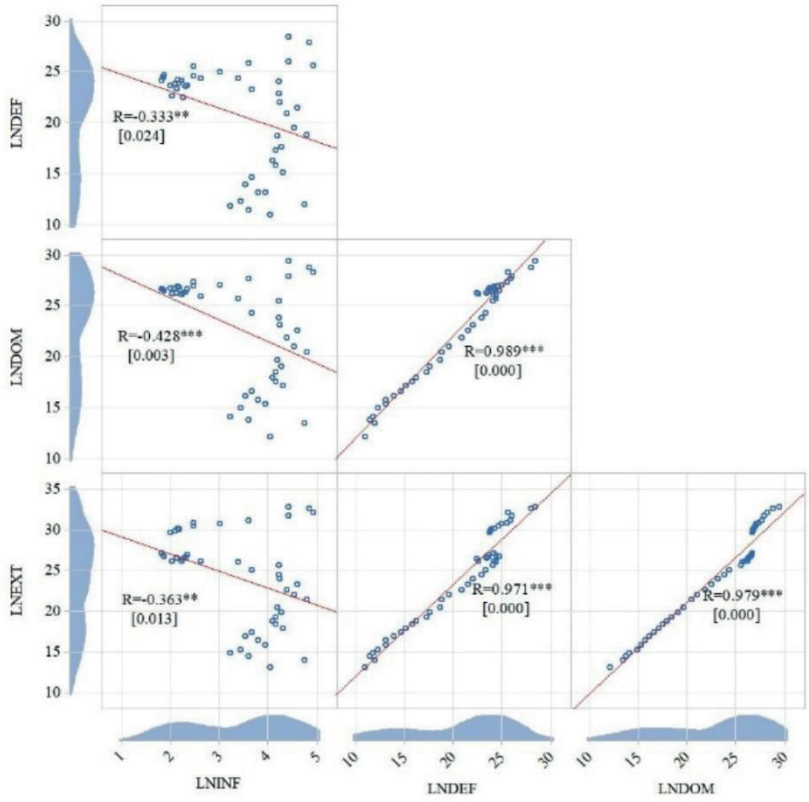
Examination of the unit root test results with structural breaks in Table 7 indicates that the structural break unit root test findings applied to the constant and constant-and-trend unit root specifications, as well as the constant, trend, and constant-and-trend structural break specifications, are consistent with each other. Moreover, these findings are also consistent with the ADF and PP unit root test results. Accordingly, based on both the ADF and PP tests and the unit root tests with structural breaks, it is concluded that the variables included in the research models are non-stationary at levels but

become stationary at their first differences and are integrated of order one (LNINF, LNDOM, LNDEF, LNEXT ~ I(1))

Since the variables are integrated of the same order, the Johansen cointegration test was applied to examine cointegration relationships in the study, and Granger causality analysis was applied to examine short-run causality dynamics.

The correlation matrix among the variables and the scatter graphs are presented in Figure 2.

Figure 2: Scatter Graphs and Correlation Matrix among Variables



When the figure is examined, it is observed that the correlations between the dependent variable and the independent variables are statistically

significant at at least the 5% significance level, negative, and range between -0.428 and -0.333. On the other hand, a statistically significant positive correlation structure exceeding 0.9 at the 1% significance level draws attention among the variables LNDOM, LNDEF, and LNEXT, which are defined as explanatory variables in different models. The high, and even near-perfect, correlations observed in the correlation matrix indicate a strong potential concern for near-perfect multicollinearity if these variables are included simultaneously as explanatory variables in the same regression model. The VIF statistics calculated for the variables were also found to be quite high (Appendix 1). Due to both the high correlations among the independent variables and the high VIF values, the variables were defined as independent variables in separate models, and the analyses were continued using three different models.

The results of the Johansen cointegration test conducted to examine the cointegration relationships among the variables are presented in Table 8.

Table 8: Johansen Cointegration Test Results

Relationship	H_0 (H_1)	Lags	Model	Trace	Max-Eigen
LNINF LNDOM	r=0 (r=1) r≤1 (r=2)	2	Model 2	35.803***[0.000] 4.230 [0.379]	31.892*** [0.0000] 4.231 [0.379]
LNINF LNDEF	r=0 (r=1) r≤1 (r=2)	1	Model 2	22.510** [0.024] 1.565 [0.862]	20.945*** [0.007] 1.165 [0.862]
LNINF LNEXT	r=0 (r=1) r≤1 (r=2)	1	Model 2	20.608** [0.023] 2.165 [0.655]	15.892**[0.011] 9.165 [0.655]

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Values in square brackets indicate p-values. Model deterministics and lag lengths were selected based on information criteria.

Based on the Trace and Max-Eigen test statistics calculated under Model 2 with a VAR structure including two lags for the first research model, it is observed that at least one cointegration vector among the variables is statistically significant at the 1% significance level ($p < 0.01$), while the hypothesis of more than one cointegration vector, which is not possible between two variables, is not rejected ($p > 0.10$). Similarly, for the second research model, the Trace and Max-Eigen test statistics calculated under

Model 2 with a VAR structure including one lag indicate that one cointegration vector is statistically significant at the 5% and 1% significance levels, respectively. For the third research model, the cointegration hypothesis is accepted at the 5% significance level based on the Trace and Max-Eigen test statistics. In line with these findings, it is concluded that the variables included in the research models have a statistically significant cointegration relationship at at least the 5% significance level. Under the assumption that the variables are cointegrated, the FMDOLS method was employed to estimate the long-run relationship coefficients. The long-run coefficients are presented in Table 9.

Table 9: FMDOLS Long-Run Coefficient Estimates

Independent Variable	Dependent Variable: LNINF		
LNDOM	0.159*** 0.030 5.262 [0.000]	-	-
LNDEF	-	0.109*** 0.023 4.756 [0.000]	-
LNEXT	-	-	0.099*** 0.029 3.402 [0.001]

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Values in square brackets indicate p-values. Model deterministics and lag lengths were selected based on information criteria.

When the Table is examined, it is observed that the LNDOM variable has a statistically significant and positive long-run effect on the LNINF variable at the 1% significance level (β_1=0.159, p<0.01). Accordingly, it can be stated that a 1% increase in domestic debt in the Turkish economy leads to a 0.159% increase in the inflation rate.

It is observed that the LNDEF variable has a statistically significant and positive long-run effect on the LNINF variable at the 1% significance level (β_2=0.109, p<0.01). Accordingly, a 1% increase in the budget deficit in the Turkish economy leads to a 0.109% increase in the inflation rate.

It is also observed that the LNEXT variable has a statistically significant and positive long-run effect on the LNINF variable at the 1% significance level (β_3=0.099, p<0.01). Accordingly, a 1% increase in external debt in the Turkish economy leads to a 0.099% increase in the inflation rate.

The results of the Granger causality test conducted to examine the short-run dynamics among the variables are presented in Table 10.

Table 10: Granger Causality Analysis Results

Casuality	Lag	Granger Test	[p]
LNDEF → LNINF	2	$\chi^2_{(2)}$=0.855	[0.836]
LNINF→ LNDEF		$\chi^2_{(2)}$=11.039**	[0.016]
LNDOM → LNINF	1	$\chi^2_{(1)}$=1.250	[0.265]
LNINF → LNDOM		$\chi^2_{(1)}$=11.258***	[0.001]
LNEXT → LNINF	1	$\chi^2_{(1)}$=0.113	[0.727]
LNINF → LNEXT		$\chi^2_{(1)}$=0.381	[0.537]

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Values in square brackets indicate p-values.

When the bidirectional causal relationships between LNDEF and LNINF are examined, it is observed that LNDEF is not a cause of LNINF at the 10% significance level ($\chi^2_{(2)}$=0.855, p>0.10), whereas LNINF is a cause of LNDEF at the 5% significance level ($\chi^2_{(2)}$=11.039, p<0.05). Similarly, when the bidirectional causal relationships between LNDOM and LNINF are examined, it is observed that LNDOM is not a cause of LNINF at the 10% significance level ($\chi^2_{(2)}$=1.250, p>0.10), whereas LNINF is a cause of LNDOM at the 1% significance level ($\chi^2_{(2)}$=11.258, p<0.01). When the bidirectional causal relationships between LNEXT and LNINF are examined, it is observed that no bidirectional or unidirectional causality relationship is identified between the variables at the 10% significance level.

CONCLUSION

Within the Republican period, the problems of budget deficits, external debt, domestic debt, and inflation in Türkiye began to emerge in the 1950s. Since those years, the country's fundamental economic problem has

been the inability to produce high-value-added goods, the failure to use such goods as export instruments, and the combination of this problem with an unequal income distribution domestically. Another major structural problem is the inability to transform low savings levels into investments oriented toward the production of capital goods. These issues constitute the fundamental structural problems of the Turkish economy.

The classical structural problems mentioned above have led to chronic problems whose effects continue to the present day. These chronic problems persist in the form of vicious cycles. The starting point for breaking out of these vicious cycles is the implementation of a comprehensive tax reform that includes a wealth declaration principle. Subsequently, it is necessary to abandon neoliberal economic policies. As a development model, a mixed public-oriented development model should be adopted.

References

Açba, Sait. Devlet Borçlanması [in Turkish], Ankara: Adım Yayıncılık, 1991.

Altuğ, Figen. (1996). *Konsolide bütçe açıkları* [in Turkish]: İstanbul Üniversitesi, İktisat Fakültesi Yayın No.: 554, Maliye Araştırma Merkezi Yayın No.: 80. *Kamu kesimi finansman açıkları.* https://ipfctr.org/yenisite/wp-content/uploads/2023/02/Maliye-Sempozyumu_10.pdf

Ataç, Beyhan. Maliye Politikası [in Turkish], Eskişehir: Eğitim, Sağlık ve Bilimsel Araştırma Çalışmaları Vakfı Yayınları, 1994.

Edgmond, Michael R., Ronald R. Moomaw, and Kent W. Olson. Economic and Contemporary Issues, U.S.A.: Dryden Press, 1996.

Eker, Aytaç. Devlet Borçları [in Turkish], İzmir: Takav Matbaacılık ve Yayıncılık, 1994.

Granger, C.W.J. (1969), Investigating causal relations by econometric models and cross-spectral methods, *Econometrica*, 37(3), 424-438.

-Gujarati, Damodar N., and Dawn C. Porter. Basic Econometrics, West Point: McGraw-Hill Education, 2009.

Ministry of Treasury and Finance, Central Government Domestic Debt Statistics [in Turkish], Access: https://www.hmb.gov.tr/kamu-finansmani-istatistikleri, Access date: 09.12.2025

Ministry of Treasury and Finance, General Directorate of Accounting, General Government Budget Statistics [in Turkish], Access: https://muhasebat.hmb.gov.tr/1924-2025-bütçe-istatistikleri, Access date: 08.12.2025

Istanbul Chamber of Commerce, ICC Wage Earners' Cost of Living Index [in Turkish], Access: https://ististatistik.ito.org.tr/index4.php#, Access date: 08.12.2025

Johansen, Soren. (1988), Statistical analysis of cointegration vectors, *Journal of Economic Dynamics and Control*, 12(2-3), 231-254.

Johansen, Soren. (1991), Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models, *Econometrica*, 59(6), 1551-1580.

Lipsey, G. Richard, Peter O. Steiner, Douglas D. Purvis, and Faul N. Courant. Economics, New York: Harper & Row, 1990.

Önder, İzzettin, and Hülya Kirmanoğlu. (1994). *Kamu Açıklarının Tanımlanması, Ölçümü ve Etkileri* [in Turkish]: İstanbul Üniversitesi, İktisat Fakültesi Yayın No.: 554, Maliye Araştırma Merkezi Yayın No.: 80. *Kamu kesimi finansman açıkları.* https://ipfctr.org/yenisite/wp-content/uploads/2023/02/Maliye-Sempozyumu_10.pdf

Önder, İzzettin, Hülya Kirmanoğlu, and Yeşim Kartallı. Kamu Açıkları ve Kamu Borçları [in Turkish], Ankara: Türk Harb-İş Sendikası Yayınları, 1995.

Phillips, Peter C.B., and Bruce E. Hansen. Statistical inference in instrumental variables regression with I (1) processes, *The Review of Economic Studies*, 57(1), 99-125.

Samuelson, Paul A., and William D. Nordhaus. Economics, Singapore: Mc Graw Hill, 1989.

Turhan, Salih, İzzettin Önder, and Beyhan Ataç. Maliye Politikası (Edit.: Engin Ataç) [in Turkish], 1. F., Eskişehir: Anadolu Üniversitesi Açıköğretim Fakültesi, 1990.

TÜİK, Consumer Price Indices [in Turkish], Access: https://data.tuik.gov.tr/Bulten/Index?p=T%C3%BCketici-Fiyat-Endeksi-Kas%C4%B1m-2025-54186&dil=1, Access date: 08.12.2025

Vural, Savaş. İktisat Politikasına Giriş [in Turkish], İstanbul: Ar Yayın Dağıtım, 1982.

Yaşa, Memduh. Devlet Borçları [in Turkish], İstanbul: 1981.

APPENDIX

Appendix 1: Variable VIF Statistics

Variable	VIF
LNDEF	47.337
LNDOM	66.749
LNEXT	24.920

Chapter 5

STRUCTURAL DYNAMICS OF ACCOUNTING AND FINANCIAL MANAGEMENT IN SMES DIGITAL TRANSFORMATION AND STRATEGIC RESILIENCE

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1. Introduction

Small and medium-sized enterprises (SMEs) are considered one of the fundamental dynamics of production, employment, and regional development in both developed and developing economies. In the Turkish economy, SMEs constitute the vast majority of all businesses, forming the backbone of the economic system. However, the decisive role of these businesses within the economic structure is directly related to their financial management capacity. Their limited resources, difficulties in accessing finance, and relatively low levels of institutionalization make SMEs more financially vulnerable. This vulnerability is often further exacerbated by a lack of financial knowledge, inadequate planning, and low risk awareness; the literature clearly emphasizes that weak financial management is one of the main causes of SME bankruptcies (Karadag, 2015; Zhang and Huang, 2023; Nanda et al., 2024).

In SMEs, accounting and financial management are often treated as merely fulfilling legal obligations. This approach prevents an adequate assessment of accounting's role in strategic decision-making processes. However, accounting is not just a system for recording past transactions, but also an information production mechanism that guides the future of the business. Analyzing, interpreting, and integrating financial data into managerial decision-making processes is critically important for the sustainability of the business. In this context, addressing budgeting, financial reporting, cash flow management, and working capital within a holistic system significantly improves the profitability, liquidity, and growth performance of businesses (Dongming et al., 2023; Okeke et al., 2024; Hiremath et al., 2025).

The effectiveness of accounting and financial management is not limited to financial performance indicators but also directly affects a company's resilience to crises and its competitiveness. Particularly in recent years, during the global economic fluctuations and the post-pandemic period, it has been observed that businesses with low financial management capacity have been unable to continue their operations. The fact that businesses unable to effectively manage cash flow, control costs, and foresee financial risks are forced to withdraw from the market clearly demonstrates the vital role of financial management (Karadag, 2015; Zhang and Huang, 2023; Nanda et al., 2024). Conversely, SMEs that manage their financial processes systematically and in an integrated manner are seen to be more resilient to crises (Dongming et al., 2023; Okeke et al., 2024; Hiremath et al., 2025).

In this process, management accounting tools are among the important elements that improve the financial performance of SMEs. Costing techniques, budgeting systems, and performance indicators (KPIs) enable businesses to use their resources more effectively and make more accurate decisions. A positive and significant relationship has been shown between the use of these

tools and financial performance. However, it is assessed that the level of use of management accounting practices in SMEs is still limited, and this situation is mostly related to a lack of information and traditional management approaches (Nanda et al., 2024; Hiremath et al., 2025; Roffia et al., 2025).

In recent years, digitalization has brought about a significant transformation in the field of accounting and financial management. Accounting information systems (AIS) improve the quality of decision-making processes by enabling faster, more accurate, and transparent processing of financial data. It has been noted that digitized accounting systems significantly improve SME performance, particularly having positive effects on transparency, sustainability, and decision-making effectiveness (Lutfi et al., 2022; Tandilino and Haliah, 2022; Christanty et al., 2023; Przychocka and Sikorski, 2024; Inayah and Susliyanti, 2025; Al-Hattami et al., 2026). These systems enable businesses not only to analyze past data but also to develop predictions for the future.

Cloud-based accounting systems stand out as a key component of digital transformation. These systems provide instant access to financial data, enabling managers to make faster decisions. Research shows that cloud accounting applications have a positive impact on profitability, liquidity, and cost efficiency. Furthermore, it is stated that this effect strengthens as the digital competence level of the business increases (Inayah and Susliyanti, 2025). In addition, accounting and finance software automates repetitive tasks, offers real-time reporting capabilities, and supports strategic decision-making processes (Nkwinika and Akinola, 2023; Przychocka and Sikorski, 2024; Tandilino and Haliah, 2024).

One of the key factors determining financial performance in SMEs is the level of financial literacy and institutionalization. Financial literacy is critical for business owners and managers to correctly interpret financial data and make decisions accordingly. In this context, financial education forms the basis of sound financial decisions and strategic planning (Dongming et al., 2023; Nkwinika and Akinola, 2023; Nanda et al., 2024). At the same time, the quality of the accounting system and the competence of the human resources managing this system directly affect the accuracy of financial decisions and long-term planning capacity (Lutfi et al., 2022; Christanty et al., 2023; Harianto et al., 2025).

Assessments, particularly in the post-COVID-19 era, reveal that SMEs with strong accounting information systems and effective use of management accounting tools are more resilient to crises. These businesses have been found to manage cash flow more effectively, adapt more quickly to financial uncertainties, and be more successful in post-crisis recovery processes (Lutfi et al., 2022; Christanty et al., 2023; Roffia et al., 2025). This demonstrates that

accounting and financial management are not merely routine functions but also a strategic element at the heart of crisis management.

In conclusion, accounting and financial management in SMEs play a crucial role in terms of business sustainability, competitiveness, and growth potential. It is necessary to move beyond the traditional record-based accounting approach and adopt a data-driven financial management approach based on strategic decision-support systems. In this transformation process, increasing digitalization, financial literacy, and institutionalization levels will enable SMEs to become more resilient and competitive. The relationships between accounting systems, financial management, financial analysis, and strategic capabilities in SMEs are presented within an integrated framework (Figure 1).

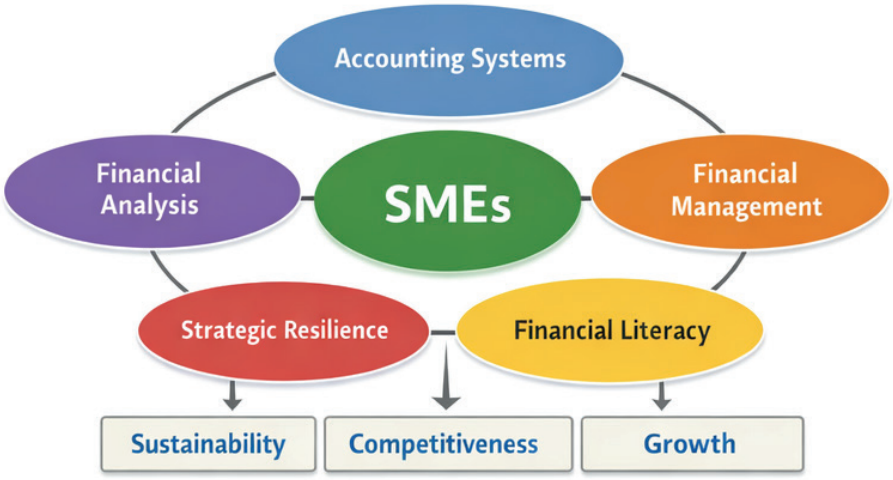

Figure 1. Conceptual framework of accounting and financial management dynamics in SMEs.

2. The Concept and Structural Characteristics of SMEs

The concept of SMEs varies from country to country, but is generally defined based on quantitative criteria such as the number of employees, annual turnover, and balance sheet size, along with some qualitative characteristics. In this context, SMEs are characterized not only by their financial size but also by their organizational structure, management approach, and market position. In the European Union, businesses with fewer than 250 employees and not exceeding certain turnover and balance sheet thresholds are considered SMEs, and these businesses are divided into sub-classes: micro, small, and medium-sized (Abdulsaleh and Worthington, 2013; Madarasi-

Szirmai et al., 2021). Similarly, in Turkey, SMEs are defined and classified within the framework of KOSGEB and relevant legislation, based on criteria such as the number of employees, annual turnover, and balance sheet size (Gao et al., 2022). These definitions not only determine the place of SMEs within the economic structure, but also provide an important framework for understanding their financial and managerial characteristics.

When examining the structural characteristics of SMEs, it is observed that the vast majority of these businesses are family-owned. The intertwining of ownership and management structures, while providing flexibility in decision-making processes, can lead to a lack of sufficient development of professional management practices. Furthermore, these businesses generally have simple organizational structures, do not hold a leading position in the market, and exhibit a structure largely based on equity financing (Gibson and Van der Vaart, 2008; Ceccarelli, 2011; Esparza-Aguilar et al., 2016; Suleman et al., 2021). This situation reveals that in many countries, SMEs operate with personalized and informal management structures. These structural characteristics directly affect the financial decision-making processes of these businesses and often lead to insufficient development of systematic financial planning and control mechanisms.

In this context, there is a strong relationship between the structural characteristics of SMEs and their accounting and financial management systems. Especially in family businesses, the intertwining of ownership and management leads to limited use of formal accounting systems and management control mechanisms. Research shows that financial information systems and management accounting practices in family SMEs are less formalized compared to non-family businesses (Esparza-Aguilar et al., 2016). Similarly, it is stated that in many SMEs, management accounting systems, budgeting practices, and performance measurement tools are not sufficiently developed due to resource constraints and lack of expertise (Nkwinika and Akinola, 2023; Razak et al., 2023). This situation leads to significant weaknesses in cost control, financial planning, and risk management processes (Farida and Setiawan, 2022; Nkwinika and Akinola, 2023; Razak et al., 2023).

Low levels of institutionalization and a lack of professional management are among the key factors limiting financial management processes in SMEs. In particular, the insufficient use of formal financial planning and control mechanisms in family businesses can lead to negative consequences such as liquidity problems, inadequate working capital, and increased risk of bankruptcy (Suleman et al., 2021; Farida and Setiawan, 2022; Nkwinika and Akinola, 2023; Abdulrasool, 2025; Amram et al., 2025). This situation increases the financial vulnerability of SMEs and threatens their long-term sustainability.

However, the structural characteristics of SMEs are not limited to disadvantages alone. These businesses possess significant advantages such as flexibility, rapid decision-making, and adaptability to changing market conditions. Furthermore, their openness to innovation and capacity to quickly develop solutions to customer needs are among the key factors that make them competitive. However, the transformation of these advantages into sustainable competitiveness is directly related to effective accounting and financial management. Indeed, studies show that the flexibility and innovation capacity of SMEs, when combined with properly structured financial management systems, transforms into a competitive advantage (Farida and Setiawan, 2022; Le and Ikram, 2022; Nkwinika and Akinola, 2023; Razak et al., 2023). As illustrated in Figure 2, the inherent structural characteristics of SMEs directly influence their accounting practices, financial management capacity, and overall competitiveness.

Figure 2. Structural characteristics of SMEs and their managerial and financial implications.

Financial literacy, accounting information systems, management accounting practices, and digitalization are prominent factors in accounting and financial management for SMEs. Business owners' and managers' mastery of financial concepts and their ability to use this information effectively directly impacts business performance and competitiveness. In this context, a strong relationship exists between financial literacy and the effective use of accounting information systems, significantly improving SME performance (Nkwinika and Akinola, 2023; Razak et al., 2023; Amram et al., 2025). Furthermore, management accounting tools such as budgeting, costing, performance evaluation, and strategic planning are important components supporting the financial performance of SMEs. However, these practices are still in their developmental stage, particularly in family businesses (Suleman et al., 2021; Razak et al., 2023).

Digitalization, on the other hand, stands out as one of the most important factors creating transformation in the accounting and financial management of SMEs. Financial software and digital accounting systems automate repetitive processes, improving reporting quality, reducing error rates, and enabling managers to make faster and more accurate decisions. The use of these systems not only increases operational efficiency but also strengthens the competitiveness of SMEs (Farida and Setiawan, 2022; Nkwinika and Akinola, 2023; Razak et al., 2023; Przychocka and Sikorski, 2024).

In conclusion, while the definition of SMEs varies from country to country, it is generally based on the number of employees and financial size, complemented by qualitative characteristics such as family ownership, simple organizational structure, and limited institutionalization. These structural features lead to insufficient development of professional accounting and financial management systems in most SMEs, and weaknesses in planning and control processes. However, by increasing financial literacy, expanding management accounting practices, and adopting digital financial systems, the flexibility and innovation capacity of SMEs can be transformed into a sustainable competitive advantage.

3. Accounting Systems in SMEs

Accounting systems in SMEs are generally structured with a focus on financial accounting, and their primary function is largely limited to compliance with tax regulations. This leads to the managerial and strategic functions of accounting being relegated to the background, limiting the effective use of accounting information in internal decision-making processes. However, in the contemporary business approach, an accounting system should not only be a technical structure that enables the preparation of financial statements, but also a dynamic information system that provides decision support to managers. In this context, accounting systems need to be integrated into planning, control, and strategic decision-making processes, going beyond their financial reporting function.

The distinction between financial accounting and management accounting becomes clear at this point. While financial accounting presents the financial status and operating results of the business to external stakeholders, management accounting generates information for managers within the business and supports decision-making processes. However, it is observed that the level of use of management accounting practices in SMEs is lower compared to large-scale businesses and often remains superficial. In particular, the limited implementation of budgeting, costing, and performance measurement systems prevents critical processes such as cost control, pricing, and investment decisions from being carried out effectively (Lavia López and Hiebl, 2015; Diegtiar et al., 2021; Ma et al., 2022). This

limitation stems from resource constraints, lack of training and expertise, an overly dependent management structure on the business owner, and the perception that management accounting tools are unnecessary or complex (Lavia López and Hiebl, 2015; Diegtiar et al., 2021; Roffia et al., 2024). This situation leads to weak planning and control mechanisms in SMEs and the inability to effectively manage financial risks.

However, studies in the literature show that properly structured management accounting systems make significant contributions to SME performance. Factors such as strengthened cost control, clearer definition of strategic goals, and sounder investment decisions are directly related to the effective use of management accounting practices. In this context, it is stated that management accounting is not only a technical tool but also a management function that determines the strategic direction of the business (Lin and Yu, 2002; Lavia López and Hiebl, 2015; Diegtiar et al., 2021; Gusmao, 2025).

In recent years, digitalization has become a decisive factor in the transformation of accounting systems in SMEs. Digital accounting applications are transforming accounting systems from a purely financial record-keeping function into a structure closer to management accounting. E-invoicing, e-ledger, and e-archive applications enable accounting processes to be carried out more quickly, transparently, and traceably. Furthermore, cloud-based accounting systems and digital accounting tools offer instant access to financial data, allowing managers to make faster and more data-driven decisions. The effects of digital accounting systems are evaluated within a multi-dimensional framework. These systems improve information quality, enabling the production of more accurate and timely financial data, reduce transaction and reporting costs, and accelerate decision-making processes (Ibrahim et al., 2021; Lutfi et al., 2022; Zhao et al., 2022; Kusumawardhani et al., 2024). Simultaneously, thanks to real-time reporting capabilities, they support managers in making more effective and data-driven decisions. This situation has positive effects on business performance (Lutfi et al., 2022; Inayah and Susliyanti, 2025; Martina and Girsang, 2025). In addition, digital systems strengthen internal control mechanisms and increase transparency by increasing the traceability of records (Lutfi et al., 2022; Kusumawardhani et al., 2024; Przychocka and Sikorski, 2024). In this respect, digital accounting systems are considered not only tools that provide operational efficiency but also structures that improve the quality of corporate governance. The transformation of accounting systems in SMEs from traditional record-keeping structures to digital and decision-oriented systems is illustrated in Figure 3.

Figure 3. Transformation of accounting systems in SMEs from traditional structures to digital and decision-support systems.

However, the positive effects of digitalization on SME performance are not always at the same level. The prominence of this effect is directly related to the level of digital competence and the adequacy of the technical infrastructure of the business. In SMEs with strong digital infrastructure and high technological adaptation capacity, the contribution of digital accounting systems to performance is seen to be more significant (Lutfi et al., 2022; Zhao et al., 2022; Inayah and Susliyanti, 2025; Martina and Girsang, 2025). Furthermore, the level of financial literacy plays a critical role in this process. Business owners and managers with a high level of financial knowledge can interpret data obtained from digital systems more effectively and integrate it into decision-making processes, which positively affects financial performance (Martina et al., 2024; Martina and Girsang, 2025).

In conclusion, although accounting systems in SMEs have traditionally been shaped within the framework of tax-focused financial accounting, digitalization has the potential to transform this structure, turning accounting into an internal decision support system. However, this transformation is not limited to technological investments alone; it also requires increasing awareness of management accounting, improving financial literacy, and creating a qualified workforce. Addressing these elements holistically will enable SMEs to transform their accounting systems into a strategic management tool, thereby gaining a sustainable competitive advantage.

4. Financial Management in SMEs

Financial management is considered a fundamental management function aimed at creating value by using the resources of a business in the most effective way. In SMEs, financial management is carried out under more limited resources, restricted access to finance, and a lower level of institutionalization compared to large-scale businesses; this causes financial risks to become more prominent and more difficult to manage. However, it is stated that effective financial management practices significantly increase the competitiveness, sustainability, and survival probability of SMEs; and play a critical role, especially in terms of predicting and managing cash flow problems (Dongming et al., 2023; Nkwinika and Akinola, 2023). On the other hand, it is observed that liquidity problems and the risk of bankruptcy increase significantly in SMEs with low levels of financial literacy (Ahmed,

2022; Nkwinika and Akinola, 2023; Amaliyah and Yasmin, 2024). In this context, financial management emerges not only as a tool to improve financial performance, but also as a strategic necessity for the survival of the business.

Cash management is one of the most critical components of financial management in SMEs. Failure to regularly monitor cash flow, systematically plan cash inflows and outflows, and inadequate forecasting mechanisms can lead to liquidity problems and payment difficulties. Therefore, effective cash flow budgeting, regular cash tracking, and financial planning processes are fundamental elements in ensuring financial stability. Indeed, studies show that regular cash flow tracking and budgeting practices reduce liquidity problems, increase solvency, and support business continuity (Dongming et al., 2023; Nasimiyu, 2023; Nkwinika and Akinola, 2023; Przychocka et al., 2024). Furthermore, it has been shown that effective cash management has a strong positive relationship with profitability and plays a decisive role in ensuring financial sustainability (Kovelskiy, 2015; Mazanec, 2022; Monze and Chilolo, 2025). Conversely, poor cash management, collection delays, and disorganized financial planning are among the most common financial weaknesses encountered in SMEs (Adil, 2025; Monze and Chilolo, 2025).

Working capital management, directly related to cash management, is also critically important for the financial performance and sustainability of SMEs. Effective working capital management includes elements such as maintaining inventory at optimal levels, collecting receivables on time, and paying debts on appropriate terms. The effective management of these processes directly affects the financial balance of the business; inadequate management practices increase financing needs and lead to higher costs. In particular, effective receivables tracking shortens the cash conversion cycle, strengthening the company's liquidity structure and increasing profitability (Ahmed, 2022; Monze and Chilolo, 2025). Similarly, effective inventory management practices reduce unnecessary inventory costs, enabling more efficient use of the company's cash resources (Ahmed, 2022; Mazanec, 2022; Monze and Chilolo, 2025). In this context, various studies have shown a strong relationship between the effectiveness of working capital management practices and SME performance.

An examination of the financing structure of SMEs reveals that these businesses are largely dependent on equity and bank loans. However, these financing sources often fail to provide sufficient flexibility for SMEs due to collateral requirements, high costs, and access difficulties. This situation leads to SMEs facing financing constraints and limits their investment and growth capacity (Dongming et al., 2023; Chit and Rizov, 2024; Qasim et al., 2025). Research indicates that diversification of financing sources is more common in businesses with moderate financing constraints, and this can be considered a conscious strategic choice (Chit and Rizov, 2024).

In this context, the use of alternative financing instruments presents a significant opportunity for SMEs. Alternative financing methods such as leasing, factoring, venture capital, crowdfunding, and peer-to-peer lending facilitate businesses' access to finance and increase their financial flexibility. These instruments provide significant advantages, particularly in financing growth and innovation activities, and support the competitiveness of SMEs (Dongming et al., 2023; Qasim et al., 2025). However, it is considered that factors such as regulatory uncertainties, lack of information, and insufficient implementation capacity contribute to the limited use of these financing instruments (Dongming et al., 2023; Qasim et al., 2025).

In conclusion, financial management in SMEs is a multi-dimensional process requiring a holistic approach to cash management, working capital control, and financing strategies. Effective financial management practices not only increase the profitability of the business but also reduce financial risks, strengthen resilience to crises, and create the necessary infrastructure for sustainable growth. In this context, improving financial literacy, enhancing working capital management, and diversifying financing sources are critically important for the long-term success of SMEs.

5. Financial Analysis and Performance Evaluation

Financial analysis is considered a fundamental management tool for evaluating the current financial situation of a business and making sound predictions for the future. The limited application of financial analysis in SMEs leads to increased uncertainty in decision-making processes and inadequate management of financial risks. However, financial analysis not only allows for the evaluation of past performance but also enables the identification of potential risks in advance and the establishment of a more solid foundation for strategic decisions. In this respect, financial analysis stands out as a critical tool in SMEs, reducing decision uncertainty and supporting risk management. However, there are various structural and managerial reasons behind the lack of widespread application of financial analysis in SMEs. The low level of accounting and financial reporting competence in many SMEs, the perception that record-keeping is difficult and costly, and the insufficient understanding of financial analysis tools prevent the systematic implementation of this process. This situation limits business managers' access to critical financial information such as debt repayment timing, the contribution of sales to profitability, and the effectiveness of the cost structure, leading to significant shortcomings in decision-making processes (Prawirodipoero et al., 2019; Gardi et al., 2021; Zonna Lia and Natswa, 2021). Similarly, the literature shows that while financial tools are theoretically known in small businesses, their practical use is limited (Fernandez et al., 2025).

Financial statements and the ratios derived from them are among the fundamental tools that improve the decision-making quality of business managers and strengthen risk management. It is stated that as the comprehensibility and accuracy of financial reports increase, managers can make more accurate and data-driven decisions; this, in turn, has a positive impact on business performance (Gardi et al., 2021). In this context, financial analysis is not only a technical evaluation process but also an important decision support mechanism that determines the strategic direction of the business.

Among the most commonly used indicators in evaluating financial performance in SMEs are liquidity, profitability, activity, and leverage ratios. However, interpreting these ratios requires a more careful and contextual approach compared to large businesses. The limited resource structure of SMEs, their sensitivity to sector dynamics, and their flexible organizational structure create differences in the interpretation of financial ratios. Therefore, instead of evaluating financial ratios in isolation, they should be considered together with the sector in which the business operates, its size, and its business model (Zonna Lia and Natswa, 2021; Khadafi et al., 2021; Štefko et al., 2021; Hasidi et al., 2024; Rachmawati et al., 2024).

Liquidity ratios are important for SMEs as they indicate their capacity to meet short-term liabilities; however, high ratios should not always be considered a positive sign. Indeed, some studies show that very high current or acid-test ratios, while indicating low debt risk, can also mean that assets are not being used efficiently and that the business has "excess liquidity" (Zonna Lia and Natswa, 2021; Hussein et al., 2023; Hasidi et al., 2024). This situation may indicate that the business is not using its resources efficiently and is failing to capitalize on potential profitability opportunities.

Profitability ratios are among the most important indicators of the financial performance of SMEs. In particular, return on assets (ROA), return on equity (ROE), and profit margins reveal the extent to which a business uses its resources effectively. However, profitability ratios alone are insufficient; they should be considered together with liquidity and activity ratios. Studies show that evaluating liquidity and activity ratios together provides a more accurate understanding of their effects on profitability (Khadafi et al., 2021; Hussein et al., 2023; Hasidi et al., 2024).

Activity ratios, on the other hand, show how effectively a business uses its assets. Low turnover rates indicate that the business has idle assets and that resources are not being used effectively; Excessively high turnover rates may indicate that the business is operating beyond its capacity, and this situation may not be sustainable in the long term (Zonna Lia and Natswa, 2021; Štefko et al., 2021; Hamsyah et al., 2023; Rachmawati et al., 2024). Therefore, factors

such as the company's production capacity, sector structure, and growth strategy should be considered when interpreting activity ratios.

Findings in the literature indicate that the relationship between financial ratios and business performance can vary depending on the sector and business size. For example, some studies have determined that liquidity ratios have a positive effect on profitability, while others have found this relationship to be insignificant (Štefko et al., 2021; Syahputra, 2024; Akbar and Nugraha, 2025). This underscores the importance of not generalizing financial analysis results and evaluating each business within its own context.

In conclusion, financial analysis in SMEs is not only a tool for measuring performance, but also a mechanism that supports risk management and strengthens strategic decision-making processes. However, the effective use of this tool is possible only through the development of accounting and reporting systems, increased financial literacy, and the integration of financial analysis tools into practices by managers. When these conditions are met, financial analysis will provide a significant advantage in terms of the sustainability and competitiveness of SMEs.

6. Key Problems Encountered in SMEs

The problems that SMEs face in their accounting and financial management processes stand out as structural challenges that directly affect the financial performance, sustainability, and growth capacity of these businesses. In the literature, it is seen that the financial and managerial problems faced by SMEs are largely concentrated around difficulties in accessing finance, inadequacies in cash flow management, informal transactions, and lack of financial literacy. The major accounting and financial challenges faced by SMEs and the corresponding solution approaches are summarized in Figure 4.

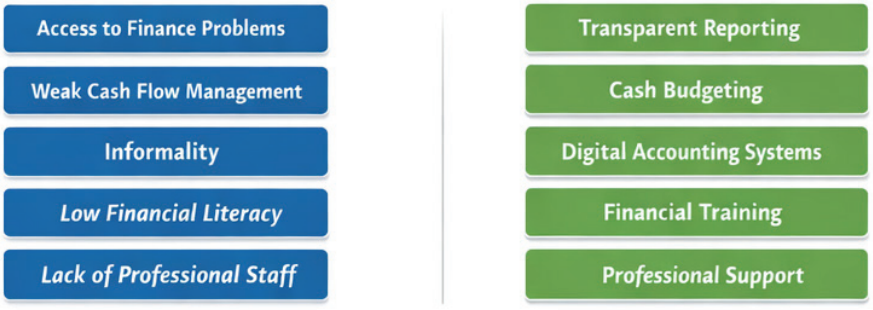

Figure 4. Major accounting and financial problems in SMEs and corresponding solution approaches.

It is stated that these problems often exhibit a structure that feeds and

deepens each other; consequently, they are directly related to low financial performance and increased bankruptcy risk. One of the most fundamental problem areas for SMEs is access to finance and insufficient capital. The vast majority of these businesses have an equity-heavy financing structure and their access to external financing sources is limited. This situation increases borrowing costs and raises the level of financial risk (Karadag, 2015; Tharmini and Lakshan, 2021; Nkwinika and Akinola, 2023). The collateral and audited financial statements required, particularly in accessing bank loans, pose a significant obstacle for SMEs lacking regular accounting records (Ezeagba, 2017; Zotorvie, 2017; Tharmini and Lakshan, 2021). In this context, the lack of financial transparency negatively impacts not only internal management processes but also external financing opportunities.

Another significant problem area is the inadequacy of cash flow management and the tendency towards informality. In SMEs, the failure to prepare cash budgets, insufficient understanding of the difference between cash and profit, and the lack of systematic tracking of receivables can lead to liquidity crises (Nkwinika and Akinola, 2023). Furthermore, incomplete accounting records, conducting transactions through non-bank channels, and the irregular reporting of financial data are common in many SMEs (Ezeagba, 2017; Abalaka et al., 2025). Such deficiencies prevent the accurate analysis of the company's true financial situation, the healthy measurement of profitability, and the emergence of various problems in tax and credit processes. Moreover, this situation can lead to erroneous financial decisions, exposing the company to the risk of bankruptcy (Zotorvie, 2017; Tharmini and Lakshan, 2021; Rizqy Aiddha, 2024).

Low levels of financial literacy and the lack of professional finance/accounting personnel in SMEs are among the key factors that exacerbate these problems. In most SMEs, business owners or managers have limited knowledge of accounting and finance, and financial decisions are often made without professional support (Karadag, 2015; Tharmini and Lakshan, 2021; Ma et al., 2022; Zhang and Huang, 2023). Furthermore, the high cost of employing professional accounting or finance personnel and the lack of knowledge in this area lead to inadequate accounting processes in many businesses (Zotorvie, 2017; Tharmini and Lakshan, 2021). Lack of financial literacy is also directly related to the insufficient adoption of basic financial management practices such as budgeting, financial reporting, and strategic planning (Karadag, 2015; Nkwinika and Akinola, 2023; Is et al., 2025).

Various suggestions are offered in the literature to address these problems. To overcome access to finance problems, it is recommended to establish regular and transparent financial reporting systems, increase professional accounting support, and improve financial literacy levels (Karadag, 2015; Ezeagba, 2017; Tharmini and Lakshan, 2021; Nkwinika and Akinola, 2023). Regarding

addressing weaknesses in cash management, it is emphasized that cash budgets should be prepared, receivables and payables should be systematically tracked, and effective working capital management should be adopted (Tharmini and Lakshan, 2021; Nkwinika and Akinola, 2023). Furthermore, to address the shortage of professional personnel, it is suggested to expand training programs, encourage consulting accountant services, and increase practices supported by the government and professional organizations (Tharmini and Lakshan, 2021; Zhang and Huang, 2023; Sirembe et al., 2025). In conclusion, difficulties in accessing finance, inadequacies in cash flow management, informal transactions, and low financial literacy levels in SMEs, combined with a lack of professional accounting and financial management skills, severely weaken the financial performance of businesses. Overcoming these problems will be possible not only through increasing financial resources but also through strengthening record-keeping systems, raising the level of financial education, and expanding professional support mechanisms.

7. Conclusion and Future Perspectives

This study highlights that accounting and financial management in SMEs should be viewed not merely as compliance-driven technical processes, but as strategic tools that directly influence sustainability, resilience, and long-term competitiveness. The findings indicate that structural characteristics such as limited resources, family ownership, and low institutionalization often lead to weak financial practices, increasing vulnerability to liquidity problems and financial risks. In particular, inadequate cash flow management, limited use of management accounting tools, and low levels of financial literacy constrain effective decision-making and negatively affect financial performance. Conversely, SMEs that adopt integrated financial management approaches, including budgeting, working capital control, and financial analysis, demonstrate improved profitability, stability, and crisis resilience. Moreover, digital transformation has emerged as a key driver in enhancing accounting systems, enabling real-time reporting, improved transparency, and more data-driven decision-making; however, its effectiveness depends largely on the firm's digital capabilities and human capital. In this context, strengthening financial literacy, promoting the use of management accounting practices, and investing in digital financial systems are essential for improving SME performance. Future research should focus on the integration of advanced technologies such as artificial intelligence and data analytics into SME financial systems, as well as sector-specific and longitudinal analyses to better understand the long-term impacts of financial and digital transformation. Overall, adopting a holistic approach that combines technological advancement, human capital development, and institutional strengthening will be critical for ensuring the sustainable growth and competitiveness of SMEs in an increasingly complex economic environment.

References

Abalaka, J.N, Sulaiman T.H, & Ajiteru,S.A.R. (2025). Strategies and Methodologies in Nigerian Msmes Investment Decision Making and its Impact on Financial Reporting. *International Journal of Economics, Management and Accounting*, *2*(2), 74–87.

Abdulrasool, H. D. (2025). Examining the role of financial management practices in enhancing competitive cost advantage in SMEs in Iraq. *International Journal of Management and Organizational Research*, *4*(2), 124-131.

Abdulsaleh, A. M., & Worthington, A. C. (2013). Small and medium-sized enterprises financing: A review of literature. *International journal of business and management*, *8*(14), 36.

Adil, L. O. U. L. I. D., Mariam, G. A. D. M. I., Siham, L. O. T. F. I., & Zakaria, B. D. (2025). SME financing: Between the tightening of bank credit and the rise of innovative alternatives. *Journal of Contemporary Research in Business, Economics and Finance*, *7*(2), 85-94.

Ahmed, A. Y. (2022). *Working capital management and financial performance of small and medium enterprises in Garissa County, Kenya* (Doctoral dissertation, Doctoral dissertation, Doctoral dissertation, Kenyatta University).

Akbar, M., & Nugraha, R. (2025). Analysis The Impact of Liquidity Ratios, Activity Ratios, and Leverage Ratios on Profitability With Firm Size as A Moderating Variable (an Empirical Study of Transportation Sector Companies Listed on The Jakarta Stock Exchange From 2018 To 2022). *Journal of Social Research*, *4*(3), 413-428.

Al-Hattami, H. M., Mady, K., & Al-Bukhrani, M. A. (2026). Green digital accounting and sustainable entrepreneurship in emerging economies: impacts on financial sustainability and performance. *Cogent Business & Management*, *13*(1), 2601944.

Amaliyah, F., & Yasmin, A. (2024). Analisis pengelolaan kas pada UMKM. *Owner: Riset dan Jurnal Akuntansi*, *8*(4), 4602-4610.

Amram, N. R., Habidin, N. F., Hassan, H., & Zainudin, N. H. (2025). Critical Success Factors of Financial Management Practices (FMP) for Small and Medium Enterprises (SMEs) Muslim Family-owned Businesses. *Global Journal Al-Thaqafah*, *15*(1), 1-16.

Ceccarelli, A. (2011). Small and Medium Sized Enterprises. *Bankpedia Review*, *1*(2), 55-2239.

Chit, M. M., & Rizov, M. (2024). SMEs' diversification of financing sources: Strategy or desperation?. *International Journal of Finance & Economics*, *29*(3), 3123-3146.

Christanty, L., Nugroho, W. S., Nurcahyono, N., & Maharani, B. (2023). Accounting Information Systems and Financial Literacy impact on SMEs' performance. *MAKSIMUM: Media Akuntansi Universitas Muhammadiyah Semarang*, *13*(1), 59-69.

Diegtiar, O. A., Bezuhlyi, O. V., Tararuyev, Y. O., Suslova, T. O., & Romanchenko, T. V. (2021). Certain aspects of the management accounting system for small and medium-sized enterprises. *Universal Journal of Accounting and Finance*, *9*(3), 469-476.

Dongming, X., Zhiyuan, L., Yun, S., & Heng, W. H. (2023). Financial management strategies for small and medium enterprises (SMEs). *Int. J. Multidiscip. Res.*, *5*(6), 1-13.

Esparza-Aguilar, J. L., García-Pérez-de-Lema, D., & Duréndez, A. (2016). The effect of accounting information systems on the performance of Mexican micro, small and medium-sized family firms: An exploratory study for the hospitality sector. *Tourism Economics*, *22*(5), 1104-1120.

Ezeagba, C. (2017). Financial reporting in small and medium enterprises (SMEs) in Nigeria. Challenges and options. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, *7*(1), 1-10.

Farida, I., & Setiawan, D. (2022). Business strategies and competitive advantage: the role of performance and innovation. *Journal of open innovation: Technology, market, and complexity*, *8*(3), 163.

Fernandez, R. R. R., Gonzales, A. R. V., & Fernandez, E. P. B. (2025). Analysis of Financial Decision-Making in Small Enterprises: Gaps Between Financial Mathematics Theory and Business Practice. *Minerva*, *6*(sp), 28-32.

Gao, J., Jia, R., & Su, Q. (2022). *G20 entrepreneurship services report*. Singapore: Palgrave Macmillan.

Gardi, B., Abdalla Hamza, P., Sabir, B. Y., Mahmood Aziz, H., Sorguli, S., Abdullah, N. N., & Al-Kake, F. (2021). Investigating the effects of financial accounting reports on managerial decision making in small and medium-sized enterprises. *Bawan Yassin and Mahmood Aziz, Hassan and Sorguli, Sarhang and Abdullah, Nabaz Nawzad and Al-Kake, farhad, Investigating the Effects of Financial Accounting Reports on Managerial Decision Making in Small and Medium-sized Enterprises (April 28, 2021)*.

Gibson, T., & Van der Vaart, H. J. (2008). Defining SMEs: A less imperfect way of defining small and medium enterprises in developing countries. *Brookings Global Economy and Development*, *11*.

Gusmao, C. (2025). The Role Of Management Accountıng In Strategıc Decısıon-Makıng For Mıcro, Small, And Medıum Enterprıses (Msmes). Count: Journal of Accounting, Business and Management, 3(2), 53-61.

Hamsyah, H., Latif, I. N., & Dewi, C. K. (2023). Cooperative Financial Performance Analysis of Liquidity, Solvency, Profitability, and Activity Ratios. *Indonesian Journal of Sustainability Policy and Technology*, *1*(1), 30-45.

Harianto, A., Azman, N. S., Fadila, Z., & Ayuni, T. W. (2025). Enhancing financial decision-making in SMEs: The role of accounting systems and human resource competence in North Medan. *Journal of Business Integration Competitive*, *2*(1), 1-7.

Hasidi, M. H., Baheri, J., & Hajar, K. I. (2024). Financial performance evaluation using profitability and liquidity ratio analysis. *Jurnal Ilmiah Manajemen Kesatuan*, *12*(4), 1347-1358.

Hiremath, S. M., Gupta, S., Sidhu, A., Mohanty, A. K., Likhar, V., & Hota, H. (2025). Enhancing organizational performance through integrated financial practices: Insights from small and medium enterprises. *Multidisciplinary Science Journal*, *7*, 2025ss0223.

Hussein, M. Q. S., Saeed, N. A., & Ahmad, G. S. (2023). Financial ratios analysis and companies' liquidity evaluation. *Journal of Global Economics and Business*, *4*(14), 60-75.

Ibrahim, F., Ali, D. N. H., & Besar, N. S. A. (2021). Accounting information systems (AIS) in SMEs: Towards an integrated framework. In Research Anthology on Small Business Strategies for Success and Survival (pp. 611-630). IGI Global.

Inayah, A., & Susliyanti, E. D. (2025). The impact of cloud-based accounting systems on SME financial performance in the digital era. Atestasi: Jurnal Ilmiah Akuntansi, 8(2), 138-145.

Is, R., Kv, S., & Hungund, S. (2025). MSME/SME financial literacy: A systematic literature review and bibliometric analysis. *Journal of the Knowledge Economy*, *16*(4), 14378-14405.

Karadag, H. (2015). Financial management challenges in small and medium-sized enterprises: A strategic management approach. *EMAJ: Emerging Markets Journal*, *5*(1), 26-40.

Khadafi, M., Marzuki, M., Akhyar, C., Chalirafi, C., Fuadi, F., Sinta, I., & Ilham, R. N. (2021). Analysis of financial ratio determinants for increasing operating profit in MSMEs service sector: An empirical case study from barber shop business in Indonesia. *Management Research and Behavior Journal*, *1*(2), 68-73.

Kovelskiy, V. (2015). Comparative analysis of working capital management of MSMEs in India. *WSEAS Transactions on Business and Economics*, *12*(2), 289-305.

Kusumawardhani, F. K., Ratmono, D., Wibowo, S. T., Darsono, D., Widyatmoko, S., & Rokhman, N. (2024). The impact of digitalization in accounting systems on information quality, cost reduction and decision making: Evidence from SMEs. International Journal of Data and Network Science, 8(2), 1111-1116.

Lavia López, O., & Hiebl, M. R. (2015). Management accounting in small and medium-sized enterprises: current knowledge and avenues for further research. *Journal of management accounting research*, *27*(1), 81-119.

Le, T. T., & Ikram, M. (2022). Do sustainability innovation and firm competitiveness help improve firm performance? Evidence from the SME sector in Vietnam. *Sustainable Production and Consumption*, *29*, 588-599.

Lin, Z. J., & Yu, Z. (2002). Responsibility cost control system in China: a case of management accounting application. Management accounting research, 13(4), 447-467.

Lutfi, A., Alkelani, S. N., Al-Khasawneh, M. A., Alshira'h, A. F., Alshirah, M. H., Almaiah, M. A., ... & Ibrahim, N. (2022). Influence of digital accounting system usage on SMEs performance: The moderating effect of COVID-19. Sustainability, 14(22), 15048.

Ma, L., Chen, X., Zhou, J., & Aldieri, L. (2022). Strategic management accounting in small and medium-sized enterprises in emerging countries and markets: A case study from China. *Economies*, *10*(4), 74.

Madarasi-Szirmai, A., Losoncz, M., Győri, Z., Sági, J., & Hegedűs, S. (2021). SMEs and IR: evidence from Hungary. In *Development of Integrated Reporting in the SME Sector: Case Studies from European Countries* (pp. 45-69). Cham: Springer International Publishing.

Martina, S., & Girsang, C. I. (2025). An Analysis Of The Influence Of Digital Accounting System Integration And Financial Literacy On The Financial Performance Of MSMES In The Era Of Industry 4.0. Jurnal Ilmiah Accusi, 7(1), 135-144.

Martina, S., Ferdila, F., & Damanik, P. (2024). The impact of accounting digitization and financial literacy on the performance of MSMEs in Pematangsiantar City. Jurnal Ilmiah Accusi, 6(2), 349-358.

Mazanec, J. (2022). The impact of working capital management on corporate performance in small–medium enterprises in the Visegrad Group. *Mathematics*, *10*(6), 951.

Monze, R., & Chilolo, B. (2025). Enhancing SMEs Profitability Through Effective Working Capital Management: A Case Study of Lusaka's Central Business District, Zambia. *African Journal of Commercial Studies*, *6*(3), 132-145.

Nanda, S., Rani, R., Karnik, N., Khanna, L., & Agarwal, N. (2024). Surveying the crucial role of financial management in small and medium enterprises. Multidisciplinary Reviews, 6, 2023ss097.

Nasimiyu, A. E. (2023). Cashflow management practices and financial performance of small and medium business enterprises in Kenya. *African Journal of Commercial Studies*, *4*(3), 252-263.

Nkwinika, E., & Akinola, S. (2023). The importance of financial management in small and medium-sized enterprises (SMEs): an analysis of challenges and best practices. *Technology audit and production reserves*, *5*(4 (73)), 12-20.

Okeke, N. I., Bakare, O. A., & Achumie, G. O. (2024). Forecasting financial stability in SMEs: A comprehensive analysis of strategic budgeting and revenue management. *Open Access Research Journal of Multidisciplinary Studies*, *8*(1), 139-149.

Prawirodipoero, G. M., Rahadi, R. A., & Hidayat, A. (2019). The influence of financial ratios analysis on the financial performance of micro small medium enterprises in Indonesia. *Review of Integrative Business and Economics Research*, *8*, 393-400.

Przychocka, I., Sikorski, M., & Milewski, L. (2024). Cash flow management in small and medium enterprises in times of economic uncertainty. European Research Studies Journal, 27(2), 155-162.

Qasim, A., Alam, M., & Abbas, Q. (2025). Bridging the financial gap: A comparative study of traditional and alternative financing solutions for SMEs in the digital era. *The Critical Review of Social Sciences Studies*, *3*(1), 3215-3236.

Rachmawati, R., Sutrismi, S., & Anggiyasari, Y. D. (2024). Unlockıng Fınancıal Insıghts: Evaluatıng Performance Through Key Ratıos. *JAT: Journal Of Accounting and Tax*, *3*(2), 134-146.

Razak, S., Wan, N. Z. N., & Tumiran, S. D. (2023). The importance of management accounting practices (MAPS) in creating sustainability of SMEs in Malaysia. *Advanced International Journal of Business, Entrepreneurship and SMEs*, *5*(16), 79-88.

Rizqy Aiddha, Y. (2024). Analysis of Factors That Influence the use of Accounting Information by MSMEs. *International Journal of Integrated Science and Technology*, *1*, 873-882.

Roffia, P., Benavides, M. M., & Carrilero, A. (2024). Cost accounting practices in SMEs: liability of age and other factors that hinder or burst its implementation in turbulent years. International Entrepreneurship and Management Journal, 20(1), 115-139.

Roffia, P., Henschel, T., & Getzin, F. (2025). Nice to value. Unraveling the nexus between management accounting use and financial performance: A quantitative study of SMEs. *Journal of the International Council for Small Business*, *6*(1), 48-54.

Sirembe, N., Munzhelele, F., & Bamuza, R. (2025). Analysis of financial management practices in Small, Medium, and Micro Enterprises (SMMEs). *International Journal of Business Ecosystem & Strategy (2687-2293)*, *7*(3), 362-369.

Štefko, R., Vašaničová, P., Jenčová, S., & Pachura, A. (2021). Management and economic sustainability of the Slovak industrial companies with medium energy intensity. *Energies*, *14*(2), 267.

Suleman, A., Muhammad, A., & Zakaria, N. (2021). Role of succession planning and management accounting towards the performance of family-owned businesses with a moderating role of networking orientation. *PSYCHOLOGY AND EDUCATION*, *58*(1), 5458-5472.

Syahputra, S. A. D. (2024). The effect of liquidity ratio, capital structure and activity on company profitability. *Jurnal Ilmiah Manajemen Kesatuan*, *12*(6), 2165-2172.

Tandilino, C., & Haliah, N. (2024). Factors Influencing the Use of Account Information Systems and its Impact on Small and Medium Enterprises Performance: Systematic Literature Review. *Int J Bus Manag Pract*, *2*(2), 197-212.

Tharmini, T., & Lakshan, A. M. I. (2021). Impact of financial management practices on performance of small and medium enterprises–legitimacy theory perspectives. *Kelaniya Journal of Management*, *10*(1).

Zhang, J., & Huang, X. (2023). Problems in Financial Management of Small and Medium-sized Enterprises. *Academic Journal of Business & Management*, *5*(16).

Zhao, J., Zhang, L., & Zhao, Y. (2022). Informatization of Accounting Systems in Small- and Medium-Sized Enterprises Based on Artificial Intelligence-Enabled Cloud Computing. Computational Intelligence and Neuroscience, 2022(1), 6089195.

Zonna Lia, D. A., & Natswa, S. L. (2021). Assessment of financial ratio analysis for evaluation of small medium enterprises (SME) performance. International Journal of Multicultural and Multireligious Understanding, 8(8), 202–207.

Zotorvie, J. S. T. (2017). A study of financial accounting practices of small and medium scale enterprises (SMEs) in Ho Municipality, Ghana. *International Journal of Academic Research in Business and Social Sciences*, *7*(7), 29-39.