

FINANCIAL PERFORMANCE ANALYSIS OF TURKISH DEFENSE INDUSTRY COMPANIES: EVIDENCE FROM CODAS AND TOPSIS METHODS

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Abstract

Heightened interest in the defense industry is driven by increasing geopolitical tensions and conflicts, with the industry becoming a critical area in terms of economic development and domestic and foreign policy strategies. Therefore, the development of defense industry companies is quite important for countries. The purpose of this study is to examine the financial performance of ASELS, OTKAR, PAPIL, SDTTR, ALTNY, ONRYT, and KATMR companies operating in Türkiye's defense industry that are listed on BIST. Eight financial indicators are used as decision criteria: current ratio, cash ratio, leverage ratio, asset turnover ratio, inventory turnover ratio, receivables turnover ratio, net profit margin, and return on equity. In the empirical analysis, the LOPCOW method is used to determine the criterion weights, and the CODAS and TOPSIS methods are employed to rank the financial performances. The findings show that net profit margin is the most important criterion, while the cash ratio is the least. According to the CODAS method, KATMR is determined to be the most effective company. This is followed by ASELS, ALTNY, ONRYT, PAPIL, and OTKAR. The robustness of the results is tested using the TOPSIS method. The test outcomes indicate that the findings largely support each other. The minor differences between the two methods can be attributed to the sensitivity of the applied method and the reflection of the criterion weights within the methodology.

Keywords : Defense Industry, Financial Performance, LOPCOW, CODAS, TOPSIS.

Jel Classification : C44, L25, G10.

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TÜRK SAVUNMA SANAYİ FİRMALARININ FİNANSAL PERFORMANS ANALİZİ: CODAS VE TOPSİS YÖNTEMİNDEN KANITLAR

Öz

Savunma sanayine yönelik artan ilgi, yükselen jeopolitik gerilimler ve çatışmalar tarafından yönlendirilmekte olup, bu sektör ekonomik kalkınma ile iç ve dış politika stratejileri açısından kritik bir alan hâline gelmiştir. Bu nedenle, savunma sanayiinde faaliyet gösteren şirketlerin gelişimi ülkeler için büyük önem taşımaktadır. Bu çalışmanın amacı, BİST'te işlem gören Türkiye savunma sanayisinde faaliyet gösteren ASELS, OTKAR, PAPIL, SDTTR, ALTNY, ONRYT ve KATMR şirketlerinin finansal performanslarını incelemektir. Karar kriterleri olarak sekiz finansal gösterge; cari oran, nakit oranı, kaldıraç oranı, aktif devir hızı, stok devir hızı, alacak devir hızı, net kâr marjı ve özkaynak karlılığı kullanılmaktadır. Ampirik analizde LOPCOW metodu kullanılarak kriter ağırlıkları belirlenmekte ve CODAS ile TOPSİS yöntemlerinden yararlanılarak finansal performanslar sıralanmaktadır. Bulgular net kâr marjının en önemli, nakit oranının ise önemi en düşük kriter olduğunu göstermektedir. CODAS yöntemine göre KATMR firmasının en etkin firma olduğu tespit edilmektedir. Bunu sırasıyla ASELS, ALTNY, ONRYT, PAPIL ve OTKAR takip etmektedir. Sonuçların sağlamlığı TOPSİS yöntemiyle test edilmiştir. Yapılan test sonuçları, bulguların büyük ölçüde birbirini desteklediğini göstermektedir. İki yöntem arasındaki ufak farklılıklar kullanılan yöntemin duyarlılığına ve kriter ağırlıklarının yöneme yansımına bağlı olarak değerlendirilebilir.

Anahtar Kelimeler : Savunma Sanayi, Finansal Performans, LOPCOW, CODAS, TOPSİS.

Jel Sınıflandırılması : C44, L25, G10.

INTRODUCTION

The defense industry sector is a sector in which companies that produce military equipment, weapons, technology and services for the security of a country operate. However, beyond being a sector aimed solely at ensuring the security of a country, it is also one of the fundamental dynamics of economic, technological and strategic development. Thanks to its high-tech production processes, the defense industry contributes to increased research and development activities, the development of a skilled workforce, and the strengthening of domestic production capacity. This development also contributes to the growth of many other sectors (Dunne & Tian, 2013). Additionally, the defense industry supports economic independence by reducing external dependency, generates foreign exchange through its export potential, and provides competitive advantage in the global market. In these respects, the defense industry is of strategic importance as both a guarantee of national security and a driving force for sustainable economic growth (Dunne, 1995).

Turkiye has become a global player in the defense industry through its national defense industry policies implemented since the 2000s, while defense companies listed on the Borsa İstanbul (BİST) have also become a strategic portfolio component for investors. In this context, examining the financial performance of defense industry companies is important for the sustainable development of the sector, its competitiveness, and the healthy evaluation of its investment potential (d'Agostino, Dunne & Pieroni, 2019). At the same time, analyzing their financial performance provides critical information for measuring the effectiveness of company management policies and directing private sector investments. Furthermore, financial performance enables a more concrete assessment of the defense industry's overall economic contribution by revealing companies' competencies in strategic areas such as R&D capacity, production efficiency, and export potential. In this context, financial performance analyses contribute to the scientific basis of sectoral planning and resource allocation processes (Hartley, 2012).

In this multifaceted process, where there are many inputs and outputs, such as the defense industry, and where numerous parameters influence company management processes and investment decisions, it becomes difficult to make decisions. In such cases, evaluations based on different parameters can lead to inconsistent performance evaluations and differences of opinion. At this point, in situations where there are many decision-makers and many factors involved in the process, Multi-Criteria Decision

Making (MCDM) methods are used to facilitate the decision-making process. In this context, the study focuses on the Combinative Distance-based Assessment (CODAS) method, which is a modern MCDM methods. Unlike other MCDM methods, the CODAS method uses Euclidean and Taxicab distance measures to rank alternatives (Badi, Abdulshahed & Shetwan, 2018). Euclidean distance is used to calculate the shortest distance between two points. If two alternatives have equal Euclidean distances, the Taxicab distance is determined to obtain a solution. The consistency of the alternatives' rankings is also examined by conducting a sensitivity analysis with a threshold value (Ghorabae, Zavadskas, Turskis, & Antuchevičienė, 2016). In addition, the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method is used to test the consistency of the results.

The purpose of this study is to examine the financial performance of companies listed on the BIST that operate in the defense industry. The seven companies that comprise our sample are; ASELSAN Electronics Industry and Trade Inc. (ASELS), Otokar Automotive and Defense Industry Inc. (OTKAR), Papillon Defense Technology and Trade Inc. (PAPIL), SDT Space & Defense Technologies Inc. (SDTTR), Altınay Defense Technologies Inc. (ALTNY), Onur High Technology Inc. (ONRYT), and Katmerciler Inc. (KATMR). First, the criteria weights are determined using the LOPCOW method. Subsequently, the financial performance of the companies is ranked using the CODAS and TOPSIS methods. Eight financial ratios (current ratio, cash ratio, leverage ratio (%), asset turnover ratio, inventory turnover ratio, receivables turnover ratio, net benefit margin (%) and return on equity (%)) are used as decision criteria in determining the financial performance ranking. According to the findings, net benefit margin (%) is the most decisive criterion, while cash ratio has the lowest importance. In the evaluation conducted using the CODAS method, KATMR demonstrates the highest financial performance, followed by ASELS, ALTNY, ONRYT, and PAPIL. The lowest performance belongs to OTKAR. This indicates that KATMR stands out particularly in terms of benefit and operational efficiency, while OTKAR demonstrated relatively lower efficiency during the same period. The TOPSIS method, applied to test the consistency of the results, largely confirms the CODAS findings.

This paper distinguishes itself from the limited number of studies in the literature by analyzing the financial performance of BIST defense industry companies using the CODAS method, thereby contributing to the methodological gap in the field. The combined application of the CODAS and TOPSIS techniques with the LOPCOW-based weighting method provides methodological diversity and increases the robustness of the analysis results. Furthermore, this analysis, conducted using sector-specific multidimensional financial indicators, provides a comprehensive and comparative perspective that can be used in decision-making processes by policymakers and investors. Thus, the study offers practical benefits not only to the academic world but also to practitioners and strategic investors.

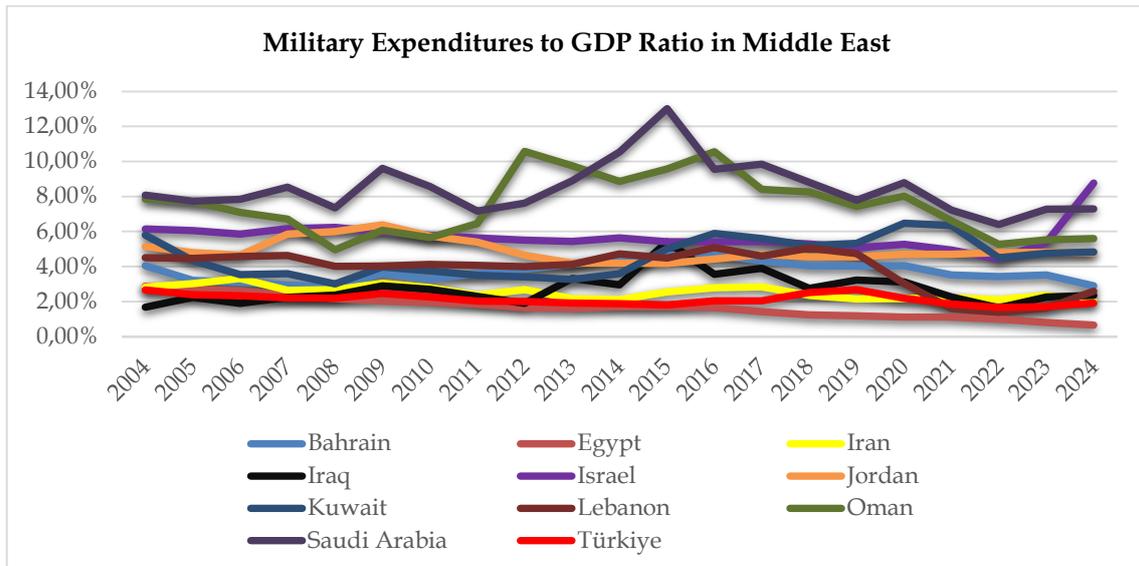
The rest of the article is organized as follows: the second section provides a literature review, the third section explains the data set and methodology, the fourth section presents the empirical results, and the fifth section interprets the conclusion

I. A BRIEF OVERVIEW OF TURKIYE'S DEFENSE INDUSTRY

This section includes various graphical indicators to clarify Turkiye's position in the defense sector in the region. First, Turkiye's military expenditure level is compared with that of Middle Eastern countries, followed by an analysis of the ratio of defense expenditure to gross domestic product (GDP) from a time series perspective. The next graph shows the annual change in defense and aerospace industry exports, while the final graph analyses the financial performance of the seven largest defense industry companies listed on the BIST over the past year. These visuals provide a multi-dimensional assessment of the structural transformation and economic impact of Turkiye's defense industry.

The military expenditure graph for Turkiye and Middle Eastern countries is shown in Figure 1. It can be observed that Turkiye's defense expenditure is below that of other Middle Eastern countries. The reason for this began with the 1973 Arab-Israel War and the Arab oil embargo. During this period, Middle Eastern countries experienced significant increases in their economic growth due to exports, foreign aid, economic output, and rising oil prices. Along with high growth rates, there has also been a simultaneous increase in military spending in Middle Eastern countries (Yildiz & Yildiz, 2019).

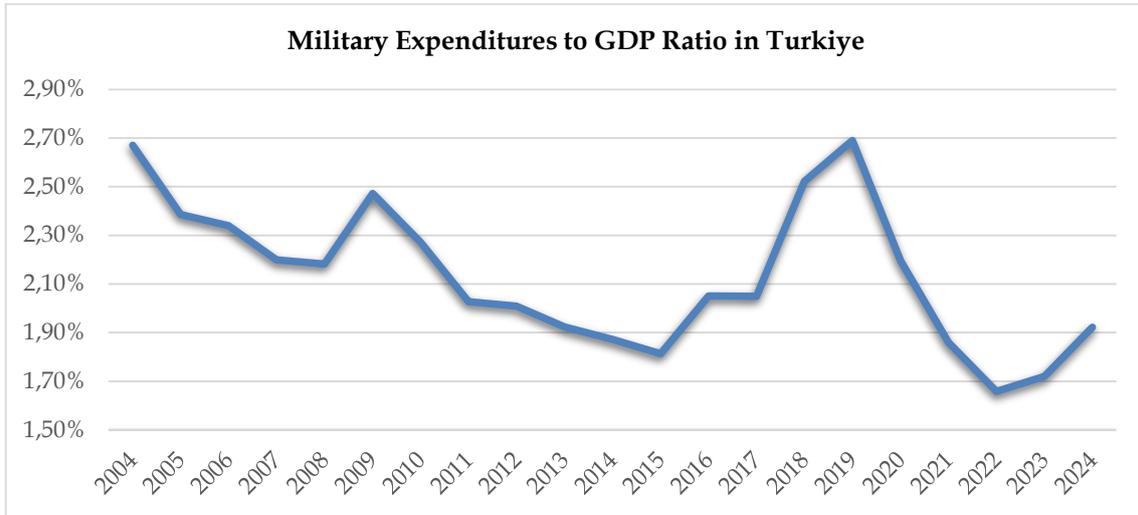
Figure 1. Defense Expenditure as A Percentage of Gross Domestic Product in The Middle East



Source: SIPRI (2025)

Figure 2 shows the ratio of Türkiye's defense expenditure to GDP for the period 2004-2024 in graphical form. Accordingly, defense industry expenditures generally follow a fluctuating trend. These fluctuations may be attributed to factors such as economic growth rate, inflation, increases/decreases in GDP, regional security threats, and changes in investments in the defense industry depending on economic and political conditions. The highest ratio was recorded in 2019 (2.69%), while the lowest ratio was recorded in 2022 (1.66%). A slight upward trend has also been observed in the last two years. This trend indicates a re-prioritization of Türkiye's defense policies or an increase in spending in response to regional/international developments (Ogel & Nuryyev, 2021; Yucel & Arslan, 2021; Mirgen & Tepeli, 2023; Aktepe & Izgi, 2024). One reason for the recent decline in defense spending is the Covid-19 pandemic that has affected the entire world. During this period, disruptions in the supply chain and difficulties in finding intermediate goods have reduced imports, leading to a decline in production and spending. Consequently, this has caused spending to appear lower (Dogan & Kabayel, 2023). Another reason is the increase in the localization rate in Türkiye's defense industry. The localization rate, which was 67% in 2019, rose to around 80% in 2023 (SBB, 2021;2024). As a result, due to its geopolitical and geostrategic position, it is not possible for Türkiye's defense spending to decrease continuously. However, although temporary declines may occur in the situations mentioned above, the overall trend in spending is upward (Dogan & Kabayel, 2023).

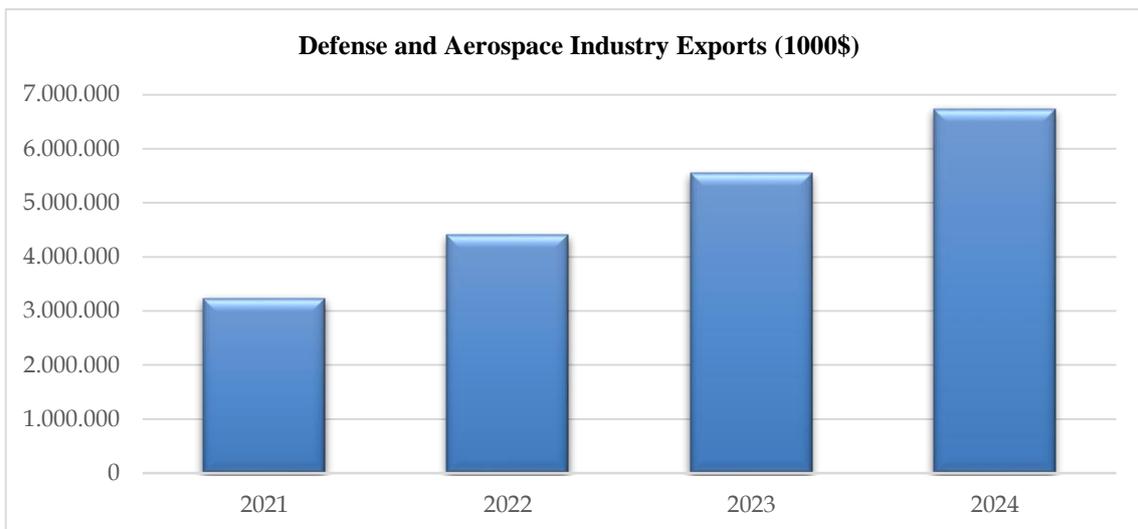
Figure 2. Defense Expenditure as A Percentage of Gross National Income in Turkiye



Source: SIPRI (2025)

Turkiye has been in a conflict zone for many years due to its geographical location. For this reason, significant steps have been taken in the defense and aerospace industries over time. Since the 2000s, Turkiye's primary motivation has been to become independent from foreign defense industries and develop its own domestic and national defense industry. Turkiye has achieved a globally significant position, particularly in the aviation sector, in the production of IHA and SIHA. It ranks among the top three in the world in this field. It is also among the top ten countries in the world capable of building its own warships (Gumus, 2024; Kalkan, 2025). Over the past 15 years, Turkiye's defense expenditures have ranged between \$10-20 billion on average (SIPRI, 2025). As of 2023, total defense and aviation exports have risen to \$5.5 billion. Also, as of 2023, R&D expenditures are at \$2.6 billion (SSB, 2023; 2024). Turkiye has begun to occupy an important position in the defense and aviation sector (Gumus, 2024; Kalkan, 2025). Figure 3 shows a graph of the last four years of data on defense and aerospace industry exports. In 2022, there was a 1.66% increase compared to the previous year, in 2023 there was a 1.72% increase compared to the previous year, and in 2024 there was a 1.92% increase compared to the previous year. In addition, defense and aerospace industry exports have doubled from 2021 to 2024.

Figure 3. Turkiye's Defense and Aerospace Industry Export Statistics

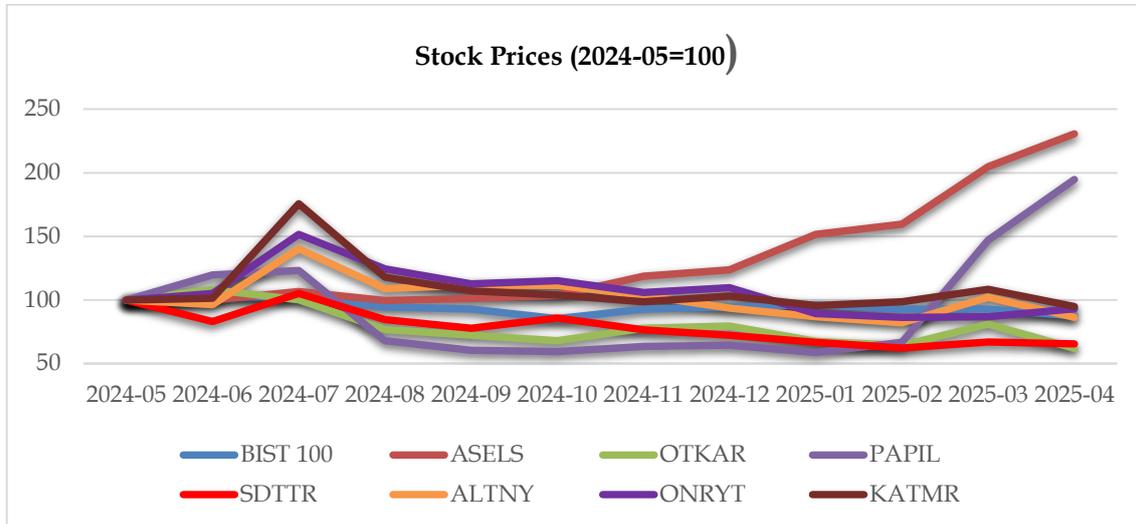


Source: TİM (2025)

Figure 4 shows the financial performance data of seven defense industry companies listed on the BIST for the common period (May, 2024 to April, 2025). According to Figure 4, ASELS and PAPIL have

stood out with their high performance in recent periods, while OTKAR and SDTTR have shown weak performance. Despite the general downward trend of the BIST, the resilience of some defense stocks indicates that sectoral dynamics remain strong, independent of market conditions. Furthermore, the data presented in the graph largely corroborates the empirical analysis results of the study.

Figure 4: Performance of Shares Traded in The Defense Industry



Source: Is Investment (2025)

II. LITERATURE REVIEW

Table 1 summaries studies evaluating the financial performance of companies traded on the BIST using MCDM methods. This literature can be classified into three main groups: method-focused studies, sector-specific analyses, and studies examining periodical effects.

When the literature is examined in terms of methods, TOPSIS, which can be described as a traditional method, is widely preferred (Yurdakul & Ic, 2003; Aytakin & Sakarya, 2013; Arslan & Yucel, 2021). However, as the limitations of this method became apparent over time, the use of alternative or complementary methods such as CODAS (Bilici, 2019), EDAS, and CoCoSo (Aktepe & Izgi, 2024) has become more widespread. Ecer & Pamucar (2022) have shown that objective approaches such as Entropy in criterion weighting enhance the reliability of decision-making processes. In this context, comparative analyses using multiple methods have increased in literature, and current methodologies have come to the fore.

A sectoral review of the literature indicates that financial performance has been examined in sectors such as tourism, automotive, food and defense industry. The studies on defense industry companies, which form the focus of this study, have largely intensified in the post-2020 period. The main reason for this is that the defense industry sector in Turkiye has undergone a relatively late development process, and a significant portion of the companies operating in the sector have been listed on the BIST within the last five years. In this context, there is limited literature specific to the defense industry. Arslan & Yucel (2021) reveal ASELS's stable performance using the MOORA and GRA methods, while Ogel & Nuryyev (2021) identify significant performance differences between ASELS, OTKAR and KATMR using the Fuzzy TOPSIS method. Mirgen & Tepeli (2023) note that sales benefit is high, but other ratios show a volatile structure. Aktepe & Izgi (2024) show that while some companies maintained their resilience during the pandemic, others, such as KATMR, became more fragile. Overall, these studies provide information for investors while also offering indicators regarding the sector's sustainable growth capacity and financial stability. Additionally, the comprehensive evaluation of companies' performance through MDMC methods contributes methodologically to decision-making processes.

Another point where the literature is grouped is studies that focus on crisis periods and analyze periodic changes. Aktepe & Izgi (2024), who focus specifically on the effects of the COVID-19 pandemic, have shown that ratios such as active benefit and return on equity became decisive during the pandemic. Such

studies reveal that financial performance analyses cannot be considered static and that flexible models need to be developed to respond to periodic shocks.

Table 1. Studies on Multi-Criteria Decision-Making Methods in the Literature

Author	Variables	Field of Work and Period	Methods
Yurdakul & Ic (2003)	Current ratio, inventory turnover ratio, debt structure ratio and benefit ratios.	Five automotive companies listed on the BIST (1998-2001)	TOPSIS
Dumanoglu & Ergul (2010)	Debt ratio, leverage ratio, turnover ratio of current assets, turnover ratio of fixed assets, net Benefit margin ratio, return on equity ratio, current ratio, acid test ratio	Eleven technology companies listed on BIST (2006-2009)	TOPSIS
Aytekin & Sakarya (2013)	Current Ratio (Current Assets / Current Liabilities), Financial Leverage Ratio (Total Liabilities / Total Assets), Equity / Total Assets, Equity / Total Liabilities, Current Liabilities / Total Liabilities, Fixed Assets / Equity, Net Sales / Assets, Net Sales / Equity, Return on Equity (Net Benefit / Equity), Return on Assets (Net Benefit / Total Assets)	Twenty food companies listed on the BIST in the food, beverage and tobacco sector (2009-2012)	TOPSIS
Sakarya & Akkus (2015)	Current ratio, acid test ratio, cash ratio, fixed asset turnover ratio, asset turnover ratio, trade receivables turnover ratio, financial leverage ratio, financing ratio, sales benefit ratio, asset benefit ratio, return on equity ratio, economic benefit ratio, short-term debt ratio, critical needs ratio, asset ratio, reinvestment ratio, trade receivables ratio, debt ratio, debt financing ratio, sales ratio, assets ratio, equity ratio and capital employed ratio.	Nineteen companies traded on the BIST in the cement sector (2010-2013)	TOPSIS
Ozcelik & Kandemir (2015)	Current assets/current liabilities, cash and cash equivalents/current liabilities, total liabilities/total assets, cost of goods sold/average inventory, net sales/average equity, net income/equity, net income/net sales, cost of goods sold/net sales.	Seven tourism companies listed on the BIST (2010-2014)	TOPSIS
Kayali & Aktas (2018)	Current ratio, total debt/total assets ratio, equity/total assets ratio, short-term foreign sources/total debt ratio, inventory turnover ratio, net Benefit/equity ratio, net Benefit/total assets ratio, gross Benefit/net sales ratio, operating Benefit/net sales ratio, net sales per employee.	Seven companies in the automotive sector traded on the BIST (2010-2015)	TOPSIS
Acar (2019)	Current assets/short-term liabilities, long-term liabilities/equity, long-term liabilities/equity, total debt/total assets, total debt/equity, total assets/equity, net income for the period/total assets, net income for the period/equity, technical Benefit/total assets, technical Benefit/total technical income, technical reserves/total assets, technical expenses/earned premiums, financial expenses/earned premiums, earned premiums/total assets, earned premiums/technical reserves, interest income/total assets.	Six insurance companies listed on the BIST Insurance Index (2008-2017)	TOPSIS

Bilici (2019)	Current ratio, cash ratio, equity ratio, equity-to-total-debt ratio, total-debt-to-total-assets ratio, current-asset-turnover ratio, equity-turnover ratio, total-asset-turnover ratio, net-income-to-total-net-assets ratio, net-income-to-equity ratio, net-income-to-net-sales ratio, operating-income-to-net-sales ratio, gross-Benefit-to-net-sales ratio	Companies operating in the tourism sector (1996-2016)	Ratio analysis and TOPSIS
Ogel & Nuryyev (2021)	Current ratio, acid test ratio, leverage ratio, financing ratio, equity turnover ratio, accounts receivable turnover ratio, current assets/total assets, non-current assets/total assets, equity turnover ratio, accounts receivable turnover ratio, inventory turnover ratio, net Benefit/equity, asset benefit, gross Benefit/net sales, operating Benefit/net sales.	Three defense industry companies listed on BIST (2010-2019)	Fuzzy TOPSIS
Yucel & Arslan (2021)	Current ratio, acid test ratio, cash ratio, accounts receivable turnover, average accounts receivable collection period, inventory turnover rate, inventory turnover period, asset turnover rate, leverage ratio, current ratio, quick ratio, equity ratio, debt-to-equity ratio, gross Benefit margin/net sales, operating benefit margin/net sales, period Benefit/net sales, period Benefit/total assets, period Benefit/total equity.	ASELSAN company (2008-2019)	Grey Relational Analysis and Multi MOORA Method
Akgun (2022)	Current ratio, cash ratio, financial leverage ratio, equity/total debt ratio, KVKYK/total assets ratio, UVYK/total assets ratio, tangible fixed assets/working capital ratio, asset turnover ratio, equity turnover ratio, working capital turnover ratio, net Benefit margin, return on equity, return on assets.	Twelve energy Companies Listed on BIST (2020-2021)	CRITIC and CODAS
Ozdemir & Parmaksiz (2022)	10 ratios used for financial analysis	Sixteen companies listed on the BIST energy sector (2019-2020)	TOPSIS and EDAS
Kilicarslan (2023)	Asset turnover, return on assets, gross Benefit margin, current ratio, EBITDA margin, financial debt ratio, leverage ratio, liquidity ratio, cash ratio, net Benefit margin and return on equity (ROE).	Eleven renewable energy companies listed on BIST (2018-2021)	Cloud Index, TOPSIS and Aras methods
Mirgen & Tepeli (2023)	Current ratio, liquidity ratio, inventory turnover ratio, equity turnover ratio, asset turnover ratio, net Benefit margin, gross Benefit margin, operating Benefit margin, asset benefit ratio, equity benefit ratio, financial leverage ratio, equity change ratio and period Benefit change ratio.	Five defense industry companies listed on BIST (2021-2022)	Financial ratio analysis
Seyranlioglu & Kara (2024)	Price/earnings ratio, market value/book value, enterprise value/EBITDA, enterprise value/sales, and earnings per share.	Five companies listed on the BIST brokerage index (2020-2022)	Entropi and CODAS methods
Aktepe & Izgi (2024)	Return on assets, Return on equity	Six defense industry companies listed on the BIST (2019-2023)	TOPSIS, EDAS and CoCoSo
Avci (2024)	Customs, Infrastructure, International Transportation, Logistics Competence and Quality, On-Time Delivery and Traceability	Top twenty countries for exports (2023)	LOPCOW MAIRCA

Defense industry investments are increasing worldwide. The progress made by countries in this area provides clues to the importance attached to defense industry investments. Therefore, the main

motivation of this study is to examine the financial performance of all companies operating in the defense industry in Turkiye and contributing to this sector. One of the most important ways to examine their performance is to compare their financial situations. Comparing the development of all defense industry companies listed on BIST in light of various indicators also provides advantages in terms of seeing the competition between companies in this field. This study makes significant contributions to existing literature in terms of both scope and methodology. Previous studies have mostly limited their analysis to a few defense industry companies. Consequently, the representativeness of the analysis results at the sectoral level is weakened. In this study, all defense industry companies listed on the BIST (seven companies) are included in the scope of the analysis, thereby strengthening sectoral representation and the generalizability of the findings. Additionally, the combined application of both the CODAS and TOPSIS methods with LOPCOW-based weighting in the financial performance evaluation increases the consistency of the ranking results and supports methodological robustness. Furthermore, the potential impact of methodological differences on the level of financial performance is highlighted. To the best of our knowledge, the use of the CODAS method on this scale for the first time in this context makes the study unique from a methodological perspective. On the other hand, the financial indicators used in the analysis are not limited to narrow areas such as liquidity and benefit but are addressed in a multidimensional framework that also includes strategic dimensions such as operational efficiency and capital structure. This comprehensive approach enables a more balanced and holistic assessment of the financial health of defense industry firms, while also providing decision-support outputs that are applicable to investors, policymakers, and industry stakeholders.

III. DATA AND EMPIRICAL METHODOLOGY

This section first defines the financial variables related to defense industry companies traded on the BIST. It then describes the methodologies of the LOPCOW method used to calculate the weight values of the variables in the analysis and the CODAS and TOPSIS methods applied in the performance ranking.

III.I. Data

We use data from 2024 for the seven defense industry companies that are listed on the BIST. Eight financial criteria are used to determine the financial performance of the companies. The criteria used and information about them are listed in Table 2. Since financial indicators must be used in both maximum and minimum directions in empirical analysis, the table also includes information about the directions of the criteria.

Table 2. Information on the Criteria Used in the Analysis

Criteria	Directions of Criteria	Criterion Codes
Current Ratio	Maximum	L1
Cash Ratio	Maximum	L2
Leverage Ratio (%)	Minimum	K1M
Active Turnover Rate	Maximum	F1
Inventory Turnover Ratio	Minimum	F2M
Receivables Turnover Ratio	Maximum	F3
Net Benefit Margin (%)	Maximum	D1
Return on Equity (%)	Minimum	D2

III.II. Empirical Methodology

a. Definition of the LOPCOW method

The LOPCOW method used to determine the weights of the criteria eliminates differences arising from the size of the data by using the percentage values of standard deviations and mean square values.

The steps of the LOPCOW method are as follows (Ecer & Pamucar, 2022);

1.Step: Creation of the decision matrix,

$$x_{ij} = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \quad i = 1, 2, \dots, m; j = 1, 2, \dots, n. \quad (1)$$

2.Step: Obtaining the normalized decision matrix,

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix} \quad (2)$$

$$r_{ij} = \frac{x_{ij} - x_{j\min}}{x_{j\max} - x_{j\min}}, \quad \text{benefit criterion} \quad (2.1)$$

$$r_{ij} = \frac{x_{j\max} - x_{ij}}{x_{j\max} - x_{j\min}}, \quad \text{Cost criterion} \quad (2.2)$$

3.Step: Creation of the percentage value matrix (PV_{ij}),

$$PV_{ij} = \left| \ln \left(\frac{\sqrt{\frac{\sum_{i=1}^m r_{ij}^2}{m}}}{\sigma} \right) * 100 \right| \quad (3)$$

4.Step: Obtaining objective weights (W_j),

$$W_j = \frac{PV_{ij}}{\sum_{i=1}^n PV_{ij}} \quad (4)$$

b. Definition of the CODAS method

The CODAS method is used to rank alternatives. It calculates distances using the Euclidean and Taksicab approaches. The steps followed in applying the method are as follows (Ghorabae et al. 2016):

1.Step: Creation of the decision matrix: The matrix in Equation 1 is used in this Step.

2.Step: Normalize decision matrix: Using Equation 5, Benefit-oriented criteria are normalized, and using Equation 6, cost-oriented criteria are normalized.

$$n_{ij} = \frac{x_{ij}}{x_{j\max}}, \quad j \in N_b, \quad \text{benefit criterion} \quad (5)$$

$$n_{ij} = \frac{x_{j\min}}{x_{ij}}, \quad j \in N_c, \quad \text{Cost criterion} \quad (6)$$

3.Step: Creation of the weighted normalized decision matrix: The values of the normalized decision matrix are multiplied by the weight values obtained using the LOPCOW method to obtain the weighted normalized decision matrix shown in Equation 7.

$$r_{ij} = w_j n_{ij} \quad (7)$$

4.Step: Determination of the negative-ideal solution: In this Step, the minimum values in each column of the weighted decision matrix are determined.

$$ns = [ns_j]_{1 \times m}, \quad ns_j = \min r_{ij} \quad (8)$$

5.Step: Calculation of Euclidean and Taksicab distances from the negative ideal solution of the alternatives: Euclidean distances are determined using Equation 9, while Taksicab distances are determined using Equation 10.

$$E_i = \sqrt{\sum_{j=1}^m (r_{ij} - ns_j)^2} \quad (9)$$

$$T_i = \sum_{j=1}^m |r_{ij} - ns_j| \quad (10)$$

6.Step: Construct the relative assessment matrix: The ψ value indicates the equality of E_i distances. The parameter τ ($0.01 \leq \tau \leq 0.05$) determined by the decision maker is used to obtain this value.

$$R_a = [h_{ik}]_{n \times n} \quad (11)$$

$$h_{ik} = (E_i - E_k) + (\psi (E_i - E_k) * (T_i - T_k)) \quad (11.1)$$

$$\psi(x) = \begin{cases} 1 & |x| \geq \tau \text{ ise} \\ 0 & |x| < \tau \text{ ise} \end{cases} \quad (11.2)$$

7.Step: Calculation of evaluation scores for alternatives: The calculated scores are ranked from highest to lowest so that the most effective alternative has the highest score.

$$h_{ik} = \sum_{k=1}^n h_{ik} \quad (12)$$

c. Definition of the TOPSIS method

The values furthest from the positive ideal solution (PIS) and the nearest negative ideal solution (NIS) are calculated using the Euclidean distance.

The steps of the TOPSIS method are shown below (Hwang & Yoon, 1980:69):

1.Step: Creating the decision matrix: In this step, the matrix in Equation 1 is used.

2.Step: Creation of the normalized decision matrix (R_{ij}),

$$R_{ij} = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix} \quad (13)$$

$$r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^m (a_{ij})^2}}, \quad \text{benefit criterion} \quad (13.1)$$

$$r_{ij} = 1 - \frac{a_{ij}}{\sqrt{\sum_{i=1}^m (a_{ij})^2}}, \quad \text{Cost criterion} \quad (13.2)$$

3.Step: Creation of the weighted normalized decision matrix (V_{ij}),

$$V_{ij} = w_j * r_{ij} \quad (14)$$

4.Step: Determining positive ideal (A^+) and negative ideal (A^-) reference points,

$$A^+ = (V_1^+, V_2^+, \dots, V_n^+) \quad (15)$$

$$V_j^+ = \begin{cases} (\max_i v_{ij}, j \in N), i = 1, \dots, m, \text{Benefit} \\ (\min_i v_{ij}, j \in N, i = 1, \dots, m, \text{Cost}) \end{cases} \quad (15.1)$$

$$A^- = (V_1^-, V_2^-, \dots, V_n^-) \quad (16)$$

$$V_j^- = \begin{cases} (\min_i v_{ij}, j \in N, i = 1, \dots, m, \text{Benefit} \\ (\max_i v_{ij}, j \in N), i = 1, \dots, m, \text{Cost} \end{cases} \quad (16.1)$$

5.Step: Determining the distances to the positive ideal (A^+) and negative ideal (A^-) reference points,

$$d_i^+ = \sqrt{(v_{ij} - v_j^+)^2} \quad (17)$$

$$d_i^- = \sqrt{(v_{ij} - v_j^-)^2} \quad (18)$$

6.Step: Calculating the proximity to the ideal reference point,

$$C_i^* = \frac{d_i^-}{d_i^+ + d_i^-}, \quad C_i \in [0, 1] \quad (19)$$

7.Step: Ranking alternatives in order of importance: As a result of calculating proximity to the ideal reference point, the alternatives are ranked from highest to lowest score, with the most effective alternative having the highest score.

IV. EMPIRICAL APPLICATION AND FINDINGS

In the study, the decision matrix, which is the first Step in all methods used to obtain criterion weighting and financial performance rankings, is shown in Table 3.

Table 3. Decision Matrix Used in CODAS and TOPSIS Methods

Companies	L1	L2	F1	F3	D1	D2	K1M	F2M
ASELS	1.52	0.24	0.52	1.51	12.73	11.49	41.78	1.82
OTKAR	1.30	0.06	0.74	2.40	-9.16	-30.77	81.54	2.33
PAPIL	14.36	7.78	0.48	3.21	-8.28	-4.27	8.62	3.18
SDTTR	2.53	0.69	0.60	3.45	0.54	0.52	35.94	1.24
ALTNY	1.71	0.40	0.35	2.42	17.23	11.61	40.65	2.52
ONRYT	11.40	4.21	0.32	5.43	8.75	3.81	17.02	4.69
KATMR	3.28	0.11	0.16	1.25	40.84	10.59	34.55	0.17

The LOPCOW method is applied to determine the importance levels of the criteria, and the score of each criterion and the importance ranking of the criteria are listed in Table 4. According to the results, D2 is the criterion with the highest importance level, while L2 is the criterion with the lowest importance level.

Table 4. Weight Values Obtained by the LOPCOW Method for Variables Used in the CODAS and TOPSIS Methods

Criteria	L1	L2	F1	F3	D1	D2	K1M	F2M
W_{ij}	0.0417	0.0298	0.1526	0.0975	0.0888	0.2175	0.1998	0.1722
Ranking	7	8	4	5	6	1	2	3

Table 5 presents the financial performance results obtained using the CODAS and TOPSIS methods for seven defense industry companies. These results show that the two most efficient companies in the CODAS method are KATMR and ASELS, while the two least efficient companies are OTKAR and SDTTR. According to TOPSIS method, the most efficient first two companies are KATMR and ASELS, while the least efficient last two companies are OTKAR and PAPIL. When both methods are evaluated together, it is determined that the most effective first two companies are the same, and only one of the least effective last two companies is different (CODAS: ADTTR ranks sixth; TOPSIS: PAPIL ranks sixth.). Table 5 also includes the absolute differences between the rankings obtained from both methods to determine whether there is a significant difference between the financial performance rankings obtained from both two methods. Overall, there is no significant difference in the results obtained using the different methods.

Table 5. Activity Scores, Ranking and Comparison According to CODAS and TOPSIS Methods

CODAS			TOPSIS			Absolute Differences
Company	Score	Rank	Company	Score	Rank	
ALTNY	2.3354	3	ALTNY	0.7052	3	0
ASELS	2.3663	2	ASELS	0.7162	2	0
KATMR	2.9293	1	KATMR	0.7438	1	0
ONRYT	1.0758	4	ONRYT	0.6309	5	1
OTKAR	-8.1085	7	OTKAR	0.2259	7	0
PAPIL	-0.2976	5	PAPIL	0.5798	6	1
SDTTR	-0.3007	6	SDTTR	0.6507	4	2

CONCLUSION

The defense industry has become an important component of economic development. With its high value-added production processes, promotion of technological innovation and contribution to skilled employment, it acts as a driving force for economies. In recent years, Türkiye has made significant investments in the defense industry, and as a result of these initiatives, it has emerged as an exporter in the defense sector. This trend has positioned the defense industry not only as a driver of economic development but also as a key factor shaping strategic development.

This study aims to evaluate the financial performance of defense industry companies listed on the BIST using MCDM methods. In this context, ASELS, OTKAR, PAPIL, SDTTR, ALTNY, ONRYT and KATMR constitute the sample of the study. Eight key financial indicators are used to measure financial performance: current ratio, cash ratio, leverage ratio (%), asset turnover ratio, inventory turnover ratio, receivables turnover ratio, net Benefit margin (%), and return on equity (%).

Using the LOPCOW technique in the empirical analysis, the relative importance of the criteria in the decision-making process is determined. Accordingly, return on equity (%) emerges as the most important criterion, whereas the cash ratio is identified as the least important. Owing to the nature of the defense industry, which requires high technology and capital-intensive investments, the efficiency with which equity is utilized (Return on Equity) becomes the most critical performance indicator from the perspective of shareholders and investors. Studies focusing on defense industry firms in Türkiye (e.g., Nuryyev, 2020) similarly emphasize that the sector's competitive strength relies on substantial financial and technological investments; thus, profitability performance is a more decisive indicator of success than liquidity. Moreover, firms in the sector typically operate under long-term government contracts, and their receivables are backed by state guarantees, which minimizes uncertainty in operational cash flows. This observation is also consistent with the liquidity–profitability trade-off theory in the literature. As noted by Eljelly (2004), holding excessive liquidity may adversely affect profitability; therefore, in growth-oriented sectors such as the defense industry, the tendency to channel cash holdings efficiently into investments reduces the relative importance of the cash ratio. Consequently, the findings obtained for the defense industry companies listed on BIST confirm that the sector's strategic priority is to maximize capital efficiency rather than maintain idle liquidity. These findings show that some variables are much more discriminating between companies in the evaluation of financial performance. Financial performance rankings are carried out using the CODAS method. KATMR is identified as the most effective defense industry company. This company is followed by ASELS, ALTNY, ONRYT, and PAPIL. The company with the lowest performance is identified as OTKAR. This situation indicates that KATMR stands out in terms of operational efficiency and benefit indicators, while OTKAR demonstrated lower financial performance compared to other companies during the period in question.

The reliability of the analysis results is re-examined using the TOPSIS method, which is widely used in literature and allows for testing the consistency of the results. The TOPSIS ranking is generally consistent with the CODAS results, with a few exceptions. However, some differences are observed, such as ONRYT's decline from fourth to fifth rank, PAPIL's decline from fifth to sixth rank, and SDTTR's rise from sixth to fourth rank. These differences can be evaluated based on the sensitivity of the method used and the reflection of the criterion weights in the method.

The findings reveal that KATMR has demonstrated superior performance in all financial criteria. In this context, it stands out as a strong alternative for short- and medium-term investments. ASELS and ALTNY, on the other hand, offer sustainable return potential for medium- to long-term investors with their stable financial structures. The changes in the rankings of ONRYT, PAPIL, and SDTTR companies are primarily due to differences in the weighting and assumptions of the methods used, rather than market conditions. This demonstrates that different MDCM methods can produce varying results even when applied to the same dataset. Therefore, investors should consider such methodological differences when making decisions and adopt a holistic perspective based on multiple evaluation models rather than relying solely on a single analysis output. While these companies technically rank in the middle, they can be evaluated cautiously within the scope of portfolio diversification during the decision-making process. Ogel & Nuryyev (2021) obtained similar results for ASELS and KATMR. Yucel & Arslan (2021) support our results for ASELS. Aktepe & Izgi (2024) and Mirgen & Tepeli (2023), however, obtain different ranking results compared to our study. This difference may stem from the methods, criteria, analysis periods, and internal dynamics of the companies used.

The findings provide decision-makers with a comprehensive overview of the financial soundness of defense industry companies. It is recommended that investors, policymakers and managers utilize such methodological approaches in their company-specific strategic decisions. In conclusion, the objective and multidimensional analysis of the financial performance of companies operating in a sector of high strategic importance such as the defense industry provides an important reference framework for sectoral competitiveness, sustainability, and resource allocation decisions. Future studies could expand the research scope by including comparative analyses of different years, considering different financial criteria, and integrating findings obtained from other MDCM methods

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Authors' Contributions	<i>Emre KILIC: Writing - Original Draft, Conceptualization, Visualization, Investigation, Supervision, Review & Editing Tahsin AVCI: Writing - Original Draft, Software Nedim MERCAN: Writing - Original Draft, Writing - Review & Editing Sevket PAZARCI: Writing - Original Draft, Investigation, Data.</i>
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