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Analysis of the Effects of the Covid-19 Process on the Financial Performance of Businesses in the Defense Industry By the TOPSIS, EDAS, CoCoSo Method: ISE Sample[1]

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Abstract

The defense industry has recently received attention due to its significant advancements. This study examines the impact of the COVID-19 pandemic on the financial performance of companies operating in the Turkish defense sector. The financial data from 2019 to 2023 of defense industry firms listed on Borsa Istanbul, namely ASELS, OTKAR, PAPIL, SDTTR, NETAŞ, and KATMER, were analyzed. The primary objective of this research is to evaluate the financial performance of these companies during the pandemic by comparing it with the pre-pandemic period. In this context, eight financial ratios related to liquidity, turnover, financial structure, and profitability were utilized to assess financial performance. The criteria weights were determined using the Entropy method, and the performance rankings of the companies were established through Multi-Criteria Decision Making (MCDM) techniques, including TOPSIS, EDAS, and CoCoSo. This study offers a novel perspective by examining the effects of the COVID-19 pandemic on Turkish defense industry firms and uncovering their financial performance compared to previous periods. According to the results of the entropy method, the most significant criteria for evaluating the financial performance of companies listed on Borsa Istanbul (BİST) are Active Profitability Ratio (APR) and Equity Profitability Ratio (EPR). In 2020, which was significantly impacted by the pandemic, companies with strong financial performance included ASELS, PAPIL, SDTTR, and NETAŞ. Conversely, KATMER was identified as one of the companies with weaker financial performance during the same period.

Keywords: *Defense industry, Financial Performance, ISE, MCDM*

JEL Codes: *C44, D81, G10*

INTRODUCTION

The coronavirus first broke out in Wuhan, China, and spread rapidly worldwide. World Health Organization 11 March 2020 COVID-19 was declared a pandemic, and our country's first case was seen on this date (Ministry of Health, 2020). Covid-19 has had an impact on both social life and commercial activities. COVID-19 has triggered the contraction of production, domestic trade, and foreign trade in the global economy, primarily in tourism, industry, services, and sectors. The COVID-19 pandemic led to merchandise trade declining by 8 percent and trade in commercial services contracting by 21 percent year-on-year in 2020 (WTO, 2021).

The COVID-19 pandemic also affected the Turkish economy, and this effect was seen intensely in the second

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quarter of 2020. The COVID-19 process has directly affected many sectors; therefore, this effect was also realized in the defense industry sector, and the foreign trade tables of the defense industry decreased in 2020. Table 1 demonstrates Turkey's defense export and import data for 2012-2022. Between 2012 and 2017, defense industry exports continued to increase at a certain level. Defense industry exports increased in 2018 and 2019. According to Table 1, it is realized that the impact of the COVID-19 pandemic was intense in 2020. Due to the COVID-19 pandemic, defense industry exports decreased in 2020 and this decrease was -16.9%. Defense industry exports increased by 40.9% in 2021. In 2022, defense industry exports increased by 36.9%, reaching 4,39 billion dollars. Defense industry imports continued at a certain level between 2012 and 2015. Defense industry imports increased between 2016 and 2019. In 2020, the impact of the Covid-19 pandemic emerged, and imports decreased. In 2022, defense industry imports amounted to 2 billion dollars (Table 1).

Table 1: The export and import data of the Turkish defense industry 2012-2022

Years	Export	Import
2012	1 260 809 984	4 150 070 402
2013	1 388 803 070	3 307 883 356
2014	1 647 759 086	4 111 989 522
2015	1 656 276 856	4 982 779 849
2016	1 677 106 338	5 566 972 692
2017	1 740 758 126	4 504 150 144
2018	2 035 923 048	4 761 589 364
2019	2 740 684 239	5 435 012 520
2020	2 278 631 824	5 152 300 101
2021	3 210 141 106	4 161 604 563
2022	4 395 997 079	2 061 197 991

Source: Defense and Aerospace Industry Manufacturers Association (SASAD)

The study aimed to scrutinize the consequences of the COVID-19 pandemic on the financial performance of BIST-registered businesses operating in the defense industry (ASELS, OTKAR, PAPIL, SDTTR, NETAŞ, KATMER). Depending on the purpose of the study, data for the 2019-2023 periods were used to examine the effects of the pandemic on businesses. The criteria weights were determined using the Entropy method, and the companies' performance rankings were conducted by applying Multi-Criteria Decision Making (MCDM) techniques, specifically TOPSIS, EDAS, and CoCoSo methods. This study holds significant importance as it addresses a gap in the existing literature by focusing specifically on the financial performance of companies

within the defense industry, an area that has not been thoroughly examined in prior research.

The absence of such studies makes this analysis particularly valuable, as it provides unique insights into the financial dynamics of a strategically critical sector, offering a foundation for future academic inquiry and practical applications in financial decision-making within the defense industry.

The structure of the paper is organized as follows. The introduction offers export and import data of the defense industry sector from 2012 to 2022. Chapter 2 provides a comprehensive literature review, encompassing studies that have employed multi-criteria decision-making methods specific to the defense industry and those that have applied these methods during the COVID-19 pandemic. Chapter 3 outlines the data sources and methodologies utilized in the study in detail. Chapter 4 analyses the financial performance of defense industry companies listed on BIST. Finally, the Conclusion and Recommendations section summarizes the study's key findings and offers strategic recommendations for the defense industry sector.

Literature Review

More studies in the literature need to examine companies' financial performance in the defense industry listed on BIST. Therefore, it is essential to conduct a study that evaluates the financial performance of the defense industry during the COVID-19 period using current data. Existing literature includes studies that utilize Multi-Criteria Decision Making (MCDM) methods specifically for the defense industry. Çelikkol (2017) employed the TOPSIS method to select a subcontractor for a Turkish company in the defense industry for visual guidance, focusing on supplier selection. Ögel and Nuryyev (2021) analyzed the financial performances of three defense enterprises (ASELS, KATMR, OTKAR) traded on Borsa Istanbul from 2010 to 2019 using the Fuzzy TOPSIS method and ranked them based on their findings. Kurtay et al. (2021) used six different MCDM methods to model and prioritize 20 projects planned for the Turkish defense industry. They concluded that these methods generally support each other with overlapping priority levels. Yücel and Arslan (2021) analyzed the financial performance of ASELSAN, a defense company listed on Borsa Istanbul, from 2008 to 2019 using Gray Relational Analysis and Multi-MOORA methods to determine periods of high financial performance. Mirgen and Tepeli (2023) examined the financial situations of defense industry companies (OTKAR, KATMR, ASELS, PAPIL SDTR) listed on BIST, using financial ratios to predict future performance, emphasizing that defense industry companies generate more profit from their sales. Rasmussen et al. (2023) utilized three MCDM methods—AHP, TOPSIS, and SECA—in the supplier selection process of an Aerospace and Defense (A&D) company. The findings demonstrate a strong correlation between the AHP and TOPSIS models while indicating little or no correlation between these MCDM models and the current supplier selection practices. Desticioglu Tasdemir and Asilogullari Ayan (2024) examined the problem of sustainable supplier selection (SSS) in the defense industry. They used the Analytical Hierarchy Process (AHP) method to determine the criteria weights. Subsequently, they employed the

Fuzzy Technique for Order Preference by Similarity to the Ideal Solution (FTOPSIS) method to determine the optimal supplier based on these calculations.

Several studies have examined the effects of the COVID-19 pandemic process using Multi-Criteria Decision-Making Methods. Some of these studies include Bayraktar (2020), Orji and Ojadi (2021), Kondak (2021), Ghosh and Saima (2021), Dağlı (2021), Meral (2021), Ersoy (2021) ,Çalış and Sakarya (2022), Ertaş and Yetim (2022), Nguyen et al. (2022), Temel and Çakır (2022), Kurt and Kablan (2022), Ghosh and Bhattacharya (2022), Sakarya and Budak (2022), Wang et al. (2022), Tezsürücü Coşansu and Okursoy (2022). Elma (2023), Makki and Alqahtani (2023), Kaplan (2023), Şenol (2023), Özgüner et al. (2023) and Özarı (2024). Bayraktar (2020) investigated the impact of the COVID-19 pandemic on BIST, specifically in the manufacturing sector. They examined 39 stocks of the manufacturing sector traded on BIST and found that the manufacturing sector earned more returns on the BIST basis than before the pandemic. Orji and Ojadi (2021) explored the integrated Multi-Criteria Decision Making (MCDM) method to assess the impact of the COVID-19 pandemic on sustainable supplier selection within Nigeria's manufacturing sector. They found that the economic and pandemic dimensions hold the highest rankings regarding calculated relative importance weights and are critical for supply chain sustainability decisions during the COVID-19 pandemic. Kondak (2021) analyzed the financial performances of food companies traded in Borsa Istanbul using online marketing activities during the COVID-19 pandemic. They used data covering the periods 2018:3-2021:3 and found that while Ülker was ranked first before the pandemic, it was ranked lower during the pandemic period. Ghosh and Saima (2021) analyzed the financial performance of commercial banks in Bangladesh during the Covid-19 pandemic and used two commonly used multi-criteria decision-making (MCDM) methods, the TOPSIS method and the HELLWIG method, to analyze the data. Based on their performance scores according to the result findings, the banks were categorized into three groups (six banks each), namely most resilient, medium resilient, and low resilient. Dağlı (2021) analyzed the financial performances of leading airline companies in Europe before and during COVID-19 and used the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method. The study's findings revealed that airline companies' financial performances differed for the three periods evaluated.

Meral (2021) analyzed the impact of the COVID-19 pandemic on the Turkish insurance sector between 2016 and 2020. They used the entropy-weighted TOPSIS method and found that the sector's performance ranked first in the non-life branch and third in the life branch in 2020. Ersoy (2021) aimed to select the best laptop computer using Entropy-based EDAS, CODAS, and TOPSIS methods for a company operating in the online commerce sector in the COVID-19 period and 6 different laptop alternatives were evaluated according to hard disk capacity, RAM, battery power, processor speed, weight, and price criteria for laptop selection of an e-commerce company. Çalış and Sakarya (2022) analyzed the financial performance of automotive firms operating in BIST during the Covid-19 period (2020-2021) and before (2018-2019) and the CRITIC-based CoCoSo method, which is one of

the multi-criteria decision-making methods, was used to analyze the financial performance of firms. According to the results, it was determined that there was no change in the financial performance ranking in the pre-pandemic period and the pandemic period, and the pandemic did not change the financial performance rankings of the firms. Ertaş and Yetim (2022) examined the financial performance of 20 businesses in the food and beverage industry traded on Borsa Istanbul during COVID-19. They applied the TOPSIS method and used 16 financial ratios as criteria. The study highlighted an improvement in the businesses' financial performance in the third and fourth quarters of 2020. Nguyen et al. (2022) evaluated the performance of the Vietnamese banking sector under the effects of COVID-19 by analyzing data from 23 Vietnamese commercial banks collected in 2019 and Q3 2020. They used the CRITIC and DEMATEL methods to calculate the weights of selected financial ratios and then determined the financial performance ranking of these banks using the TOPSIS method. Temel and Çakır (2022) analyzed the financial performance of 21 textile sector businesses traded on BIST for the 2020-2021 periods within the Covid-19 context. They used the TOPSIS method and identified the businesses with the best financial performance in 2020 as Yataş, Sönmez, and Desa, and in 2021 as Sönmez, Yataş, and Bilici. Kurt and Kablan (2022) looked into the financial performance of airline companies in the BIST transportation index during the COVID-19 pandemic. Their study revealed that the pandemic harmed the financial performance of airline transportation. Ghosh and Bhattacharya (2022) analyzed the impact of the pandemic on the financial performance of 22 listed hotels and nine listed travel agencies in India using a Multi-criteria decision-making technique, MEREC, and CoCoSo methods. Based on their findings, EIH, Advani Hotels and Resorts, and TGB Banquets performed relatively better. Sakarya and Budak (2022) examined the financial performances of retail trade sector companies traded on Borsa Istanbul between 2017 and 2020 due to the COVID-19 epidemic. They used the TOPSIS method and identified MIGROS, SOKM, and MIGROS as the most successful companies in financial performance between 2017 and 2020. Wang et al. (2022) constructed a hybrid MCDM model using Fuzzy Analytic Hierarchy Hierarchy Process (FAHP) model and Preference Ranking Technique with Similarity to Ideal Solution (TOPSIS) to assist the supplier selection process in the apparel industry in a fuzzy decision-making environment during the Covid-19 period. Tezsürücü Coşansu and Okursoy (2022). In this study, the financial performances of the firms in the BIST retail trade sector for the periods covering 2019-2021 were determined by FUCOM and VIKOR, which are multi-criteria decision making (MCDM) methods. According to the results of the analysis, BİM in 2019, ŞOK and BİM in 2020, and ŞOK in 2021 were determined as the firms with the best financial performance. Elma (2023) analyzed the financial performance of companies in the health sector, which came to the forefront globally during the pandemic-affected period, and MOORA and TOPSIS methods were used in the study. The results of the analysis display that the same companies shared the first place for both methods in three of the four periods examined. Makki and Alqahtani (2023) analyzed the financial performance of companies in the Saudi energy sector in 2019, 2020, and 2021. They applied AHP and TOPSIS methods and found that efficiency and profitability were the most significant dimensions, followed by leverage and liquidity.

Kaplan (2023) evaluated the financial performances of 8 companies in the automotive sector traded on BIST for the 2017-2021 periods, including the COVID-19 pandemic period. The study used TOPSIS and ELECTRE methods and identified DOAS, TTRAK, and FROTO as the most successful companies. Şenol (2023) analyzed the financial performance of healthcare businesses registered in Borsa Istanbul during COVID-19 using the TOPSIS method. Özgüner et al. (2023) analyzed the impact of COVID-19 on the Turkish manufacturing sector using the Analytical Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) methods. The study found that the automotive sector was most affected by COVID-19, while the pharmaceutical and medical equipment sector was the least affected. Özarı (2024) evaluated the financial performance of the enterprises operating in Borsa Istanbul in the Transportation and Warehousing Sector in the Covid 19 period and used EDAS and COPRAS methods from multi-criteria decision-making techniques and used Tobin's Q ratio to determine financial performance and widely accepted criteria such as Altman Z-Score, Springate S-Score, Taffler T-Score, Zmijewski X-Score to measure financial failure and Current and Cash Ratio from liquidity ratios.

Dataset and Methodology of The Study

The study aimed to explore the impact of the COVID-19 pandemic on the financial performance of businesses in the defense industry listed on Borsa Istanbul (BIST). Data from 2019 to 2023 were used in the study, which included six businesses in the BIST defense industry. The names and codes of the businesses included in the study are displayed in Table 2.

Table 2: Businesses Included in the Study

Code	Businesses
ASELS	ASELSAN Electronic Industry and Trade Inc.
OTKAR	OTOKAR Automotive and Defense Industry Inc.
PAPIL	PAPİLON Defense Technology and Trade Inc.
SDTTR	SDT Space and Defense Technologies Inc.
NETAŞ	NETAS Telecommunication Co.
KATMER	KATMERCİLER Vehicle Mounted Equipment Industry and Trade Co.

Source: Public Disclosure Platform (KAP)

The research utilized a dataset obtained from the financial reports of businesses during reporting periods, which were published on KAP and included as part of the study. The study focused on financial ratios that illustrate the liquidity, profitability, financial structure, and activity levels of businesses. Table 3 provides a detailed classification of these financial ratios commonly used in the literature. The current ratio reflects the relationship between current assets and short-term liabilities. Meanwhile, the cash ratio indicates the proportion of a business's cash reserves that can cover its short-term debts.

Additionally, the liquidity ratio demonstrates current assets, excluding stocks, to short-term liabilities (Yaslıdağ, 2018, p.161-163). Furthermore, the equity profitability ratio compares the efficiency of an investment with its return (Karapınar & Zaif, 2021, p.316). At the same time, the activity profitability ratio displays the total profit per asset a business owns. The Asset Turnover ratio assesses the efficiency of all business assets, and the Stock Turnover rate measures how quickly a business sells its stock. Lastly, the financial leverage ratio demonstrates the proportion of assets financed by external sources versus those financed by equity (Yaslıdağ, 2018, p.163).

The normalization methods, weighting method, Multi-Criteria Decision Making methods, financial ratios and code used in the study to measure the financial performance of the companies are indicated in Table 3. In addition, figure 1 demonstrates the flow diagram created for the study.

Table 3: Normalization Method, Weighting MCDM Methods, Financial Rations used in this Study

Normalization Method	**Weighting**	**MCDM Methods**	**Financial Rations and code**
Sum, Vector, Max-min	Entropy Method	-Technique For Order Preference by Similarity to Ideal Solutions (TOPSIS), -Evaluation Based on Distance From Average Solution (EDAS), -Combined Compromise Solution (CoCoSo) Method	**-Liquidity Rations** Current Ratio (CUR) Liquidity Ratio (LİR) Cash Ratio (CAR) **-Activity Rations** Asset Turnover, (AST) Stock Turnover (STT) -P**rofitability Rations** Active Profitability Ratio (APR) ratio Equity Profitability Ratio (EPR) **-Financial Structure and ratio** Leverage Ratio (LER)

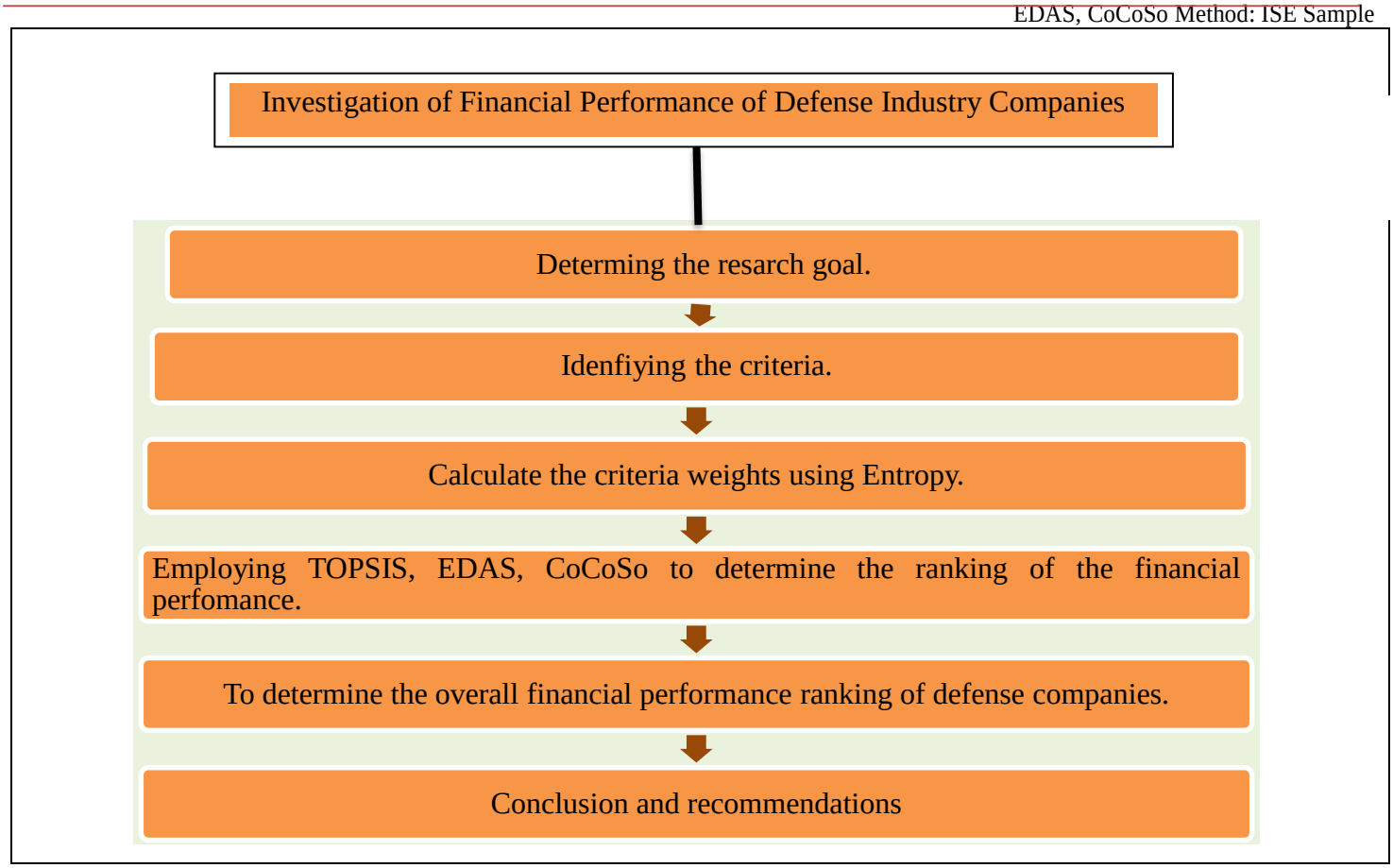

Figure 1: Flow diagram of the study

The Entropy Method

The concept of entropy, initially introduced by Rudolph Clausius in 1865, measures system disorder and uncertainty (Zhang et al., 2011). Over time, it has been widely adopted across various scientific disciplines. In 1948, Shannon adapted the concept to the field of information theory. The entropy method now quantifies the valuable information derived from a given data set (Wu, 2011). This method determines the weight coefficients of objective criteria by evaluating the uncertainty present in the information content of the decision matrix. It achieves this by assessing the degree of mutual contrast among individual criterion values across the alternatives for each criterion and subsequently across all criteria. Due to its direct derivation of weight values from criteria data, the method is considered objective, eliminating potential biases related to subjectivity, lack of expertise, or the involvement of a decision-maker.

Additionally, the nature and orientation of the criteria are independent of the process. In the initial step, the criteria values for the alternatives are normalized, resulting in a normalized decision matrix. The entropy values, representing the information content of the normalized decision matrix for each criterion, are constrained within the 0 to 1 range by applying a constant. The divergence level is calculated by assessing the average information content across all criteria. Lastly, the relative weights of the criteria are determined through simple additive

normalization, providing a measure of the intensity of contrast among the criteria (Petrovic et al., 2024, p.38).

Table 4: Phases of the entropy method

1st Step: Construct the Decision Matrix	$\begin{Bmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{22} & \dots & X_{2n} \\ \dots & \dots & \dots & \dots \\ X_{m1} & X_{m2} \dots & & X_{mn} \end{Bmatrix}$	**(1)**
2nd Step: Normalize the Decision Matrix	$Pij \frac{X_{ij}}{\sum_{i=1}^{m} Xij}$	**(2)**
3rd Step: Calculate the Entropy for Each Criterion	$E_j = -k \sum_{j=1}^{n} pijlnpij$	**(3)**
4th Step: Determine the Degree of Diversification (d_j) for Each Criterion	d_j= 1- E_j, $\forall_j$	**(4)**
5th Step: Calculate the Entropy Weight for Each Criterion	$Wi = \frac{1-ei}{\sum_{i=1}^{m}(1-ei)}$	**(5)**

Technique for Order Preference by Similarity to Ideal Solutions (TOPSIS)

The TOPSIS method, which stands for Technique for Order Preference by Similarity to an Ideal Solution, was introduced in the work of Chen and Hwang (1992) and further developed by Hwang and Yoon (1981). The fundamental principle of this method is to select an alternative that is as close as possible to the ideal solution and as far away as possible from the negative ideal solution (Opricovic & Tzeng, 2004, p.488). Just like in any decision-making process, defining the necessary criteria is crucial. The alternatives are evaluated by following the method's required steps. In TOPSIS, the goal is to choose the alternative closest to the positive ideal solution and farthest from the negative ideal solution. The positive ideal solution maximizes the utility criterion, while the negative ideal solution minimizes the utility criterion. By revealing positive and negative ideal solutions, the TOPSIS method helps identify suitable solutions. This method is user-friendly and can be applied in various fields due to its precise evaluation and interpretation of results (Kurtay et al., 2021, p.8).

Table 5: Phases of the TOPSIS method

1. Step: Construct the Decision Matrix	$\begin{Bmatrix} a_{11} & a_{12} & \dots & a1n \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{m1} & a_{m2} \dots & & a_{mn} \end{Bmatrix}$	**(6)**
2. step: Performing vector normalization, the normalization decision matrix (R) is formed**.**	$r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{k=1}^{m} a^2{}_{kj}}}$	**(7)**
3. Step: If there are criterion weights (wi) determined in the problem being examined, the weighted normalized decision matrix (V) is obtained by multiplying it with the normalized decision matrix (R). Results	$\begin{Bmatrix} w_1 r_{11} & w_2 r_{12} & \dots & a_n r_{1n} \\ w_1 r_{21} & w_2 r_{22} & \dots & a_n r_{2n} \\ \dots & \dots & \dots & \dots \\ w_1 r_{m1} & w_2 r_{m2} & \dots & a_n r_{mn} \end{Bmatrix}$	(8)

4. Step. Ideal positive for all alternatives(A*) and ideal negative (A^-) solutions are available.	$A^*= \{(\max_i V_{ij})\ j\ E\ j\ \}, \{(\min_i V_{ij})\ E\ J^{\prime}\ \}$ $A^-=\{(\min_i V_{ij})\ j\ E\ j\ \}, \{(\max V_{ij})\ E\ J^{\prime}\ \}$	(9)
5. Step: Calculating the distances for each alternative, the Ideal Positive Discrimination (S_i^*) and Ideal Negative Discrimination (S_i^-) measurements are calculated.	$S_i^* = \sqrt{\sum_{j=1}^{n}[vij - v_j^*)2}$ $S_i^- = \sqrt{\sum_{j=1}^{n}[vij - v_j^-)2}$	(10)
6. Step: The relative number of alternatives considered in the sorting process is performed by calculating the distances (Ci*).	$c_i^* = \frac{S_{ij}}{S\bar{i} + S_i^*}$	(11)

The EDAS (Evaluation Based on Distance From Average Solution) Method

The EDAS (Evaluation based on Distance from Average Solution) method is a multi-criteria decision-making (MCDM) approach introduced into the literature in 2015. The authors of this method—Keshavarz Ghorabaee, Zavadskas, Olfat, and Turskis—tested its validity by comparing it with other well-known MCDM methods such as COPRAS, TOPSIS, SAW, and VIKOR. These comparative analyses validated the EDAS method as a reliable decision-making tool (Keshavarz Ghorabaee et al., 2015, p.435-451). According to the EDAS method, the best alternative is determined based on distance from the average solution rather than from a positive (ideal) or negative (anti-ideal) solution, as with other methods. In EDAS, two types of distances need to be calculated to assess the preferability of alternatives: the positive distance from the average solution and the negative distance from the average solution. These distances are computed based on the type of criteria, whether they are benefit or cost-oriented. In the EDAS method, the selected criteria are considered independent (Ecer, 2020, p.274). The stages of the EDAS method are displayed in the table 6.

Table 6: Phases of the EDAS method

1. Step: Creating the Decision Matrix ($X=x_{ij}$)	$a_{11}\ \ a_{12}\ \ \ldots\ \ a_{1n}$ $a_{21}\ \ a_{22}\ \ a_{2n}$ $\ldots\ \ \ldots\ \ \ldots\ \ \ldots$ $a_{m1}\ \ a_{m2}\ldots\ \ a_{mn}$	**(12)**
2. Step: Creation of Average Values Matrix	$AVj = \frac{\sum_{i=1}^{n} xij}{n}$	**(13)**
3. Step: Creation of Positive and Negative Distance Matrices from the Mean	$PDA= [PDA_{ij}]_{nxm}$ $NDA= [NDA_{ij}]_{nxm}$	*(14)*

4. Step: Calculation of Weighted Total Values	$SP_i=\sum_{j=1}^{m} wj\ x\ PDAij$ $SN_i=\sum_{j=1}^{m} wj\ x\ NDAij$	***(15)***
5. Step: Normalization of Total Weighted Distance	$NSPi = \frac{SPi}{maxi\ (SPi)}$ $NSNi = 1 - \frac{SPi}{maxi\ (SNi)}$	(**16**)

Combined Compromise Solution (CoCoSo) Method

The CoCoSo (Combined Compromise Solution) method is a new multi-criteria decision-making (MCDM) approach proposed by Yazdani, Zarate, Zavadskas, and Turskis in 2019. This method emerged from integrating two existing MCDM techniques: SAW (Simple Additive Weighting) and EWP (Exponentially Weighted Product). CoCoSo combines the strengths of both methods to provide a more comprehensive decision-making framework (Ecer, 2020, p.299). The CoCoSo method offers a compromised solution for addressing multi-criteria decision-making (MCDM) problems. After identifying the alternatives and relevant criteria, the procedure of the CoCoSo model is outlined as follows (Yazdani et al., 2019, p.2507). The stages of the CoCoSo method are indicated in the table 7.

Table 7: Phases of the CoCoSo method

Step 1: A decision matrix is constructed, as revealed in Equation 17.	$x = (x_{ij})m \times n = \begin{bmatrix} x_{11} & x_{12} & \dots x_1 n \\ x_{21} & x_{22} & \dots xzn \\ \dots & \dots & \\ x_{1n_i} & x_{m_2} & xm_n \end{bmatrix}$	**(17)**
Step 2: The compromise normalization Equations (18) and (19) normalize the criteria values, respectively.	$r_{ij} = \frac{X_{ij-min i}X_{ij}}{max_i X_{ij-min i}X_{ij}}$	(18)
	$r_{ij} = \frac{max_i X_{ij} - X_{ij}}{max_i X_{ij-min i}X_{ij}}$	(19)
Step 3: The sum of the weighted comparability sequence SiSi and the total of the power weighted comparability sequence PiPi for each alternative is calculated using Equations (20) and (21), respectively.	$S_i = \sum_{j=1}^{n}(w_j r_{ij})$	(20)
	$P_i = \sum_{j=1}^{n}(r_{ij})^{w_j}$	(21)
Step 4: The relative weights of the alternatives are calculated based on the following aggregating strategies. Three performance score strategies are applied in this stage to calculate the relative weights of other options. The arithmetic means of the sums of the WSM (weighted sum method) and WPM (weighted product method) scores are expressed by Equation (21). Equation (22) is the sum of the relative scores of WSM and WPM compared to the best. Equation (23) generates the balanced compromise of the WSM and WPM model scores. In this paper, the value of $\lambda\lambda$ is considered as 0.5 (λ=0.5λ=0.5) for the beginning analysis.	$k_{ia} = \frac{S_i + P_i}{\sum_{i=1}^{m}(P_i + S_i)}$	(21)
	$k_{ib} = \frac{S_i}{min_i S_i} + \frac{P_i}{min_i P_i}$	(22)
	$k_{ic} = \frac{\lambda(Si) + (1-\lambda)(P_i)}{\lambda_{max i} S_i + (1-\lambda)}; 0 \le \lambda \le 1$	(23)
Step 5: The final ranking of the alternatives is calculated based on the kiki value, i.e., appraisal score (as more significant or better), as seen in Equation 24.	$k_i = (k_{ia}k_{ib}k_{ic})^{\frac{1}{3}} + \frac{1}{3}(k_{ia} + k_{ib} + k_{ic})$	(24)

RESULTS

The Entropy Method Results

The entropy method was utilized to determine the criteria weights of the business in the defense industry sector registered in BIST. The purpose of applying the Entropy method in the study is to determine the weights of the criteria objectively. As in other Multi-Criteria Decision-Making Methods, it is concluded that this method's criteria are benefit or cost-orientated. Therefore, the criteria were determined as a benefit (CUR, LIR, CAR, AST, STT, APR, EPR) and cost (LER). The criteria values of the financial ratios obtained from the calculation of the Entropy method were used as weighting values in TOPSIS, EDAS, and CoCoSo methods, and the results were compared. Firstly, the decision matrix of the defense industry companies for the 2019-2023 period was created for the Entropy method. In addition, normalization of the decision matrix values and weighting over the normalized values should be performed. Table 8 emphasizes the decision matrix of businesses in the defense industry. Since the values of PAPIL and NETAŞ (APR-EPR) are negative, the positivisation process was applied due to not doing the calculation while finding ln values. The values determined as a result of these processes are displayed in Table 8.

Table 8: Constructed Decision Matrix

ASELS	**Years**	**CUR**	**LİR**	**CAR**	**AST**	**STT**	**APR**	**EPR**	**LER**
	2023	1,45	0,81	0,13	0,46	1,65	5,27	9,30	41,31
	2022	1,41	0,88	0,18	0,70	2,78	1,34	2,43	44,20
	2021	1,38	0,93	0,15	0,50	2,05	17,71	32,83	44,34
	2020	1,59	1,14	0,33	0,54	2,30	14,90	28,36	46,92
	2019	1,80	1,23	0,45	0,58	2,40	14,81	28,27	47,06
OTKAR	**Years**	**CUR**	**LİR**	**CAR**	**AST**	**STT**	**APR**	**EPR**	**LER**
	2023	1,15	0,80	0,33	0,85	2,66	7,08	28,16	74,14
	2022	1,11	0,67	0,17	1,09	3,23	12,37	50,30	75,49
	2021	1,39	0,89	0,23	0,87	2,02	20,18	80,19	75,01
	2020	1,49	0,87	0,24	0,83	1,63	17,63	75,17	76,76
	2019	1,87	1,13	0,21	0,98	2,07	14,12	68,45	76,19
PAPIL	**Years**	**CUR**	**LİR**	**CAR**	**AST**	**STT**	**APR**	**EPR**	**LER**
	2023	19,08	15,40	14,02	0,22	0,82	18,22	19,51	6,80
	2022	19,66	17,00	14,15	0,35	2,51	-23,21	-25,27	6,43
	2021	12,64	11,40	9,68	0,27	2,23	22,49	24,12	8,25
	2020	29,28	25,71	24,41	0,29	2,31	10,11	35,31	4,82
	2019	10,33	9,33	8,90	0,00	0,00	0,00	47,94	10,51
SDTTR	**Years**	**CUR**	**LİR**	**CAR**	**AST**	**STT**	**APR**	**EPR**	**LER**
	2023	2,71	1,72	0,86	0,61	1,18	19,99	31,39	37,81
	2022	3,29	2,34	1,59	1,99	2,57	14,70	22,87	32,99
	2021	2,29	1,52	0,75	1,27	2,25	32,87	73,00	44,21
	2020	1,80	1,06	0,29	1,14	2,18	27,25	85,90	70,21
	2019	1,66	0,94	0,37	0,00	0,00	0,00	0,00	65,21
NETAŞ	**Years**	**CUR**	**LİR**	**CAR**	**AST**	**STT**	**APR**	**EPR**	**LER**
	2023	0,76	0,68	0,02	1,40	15,69	2,01	86,26	96,11
	2022	0,80	0,69	0,05	1,02	9,00	-0,78	-121,48	99,58

	2021	0,84	0,73	0,15	0,76	9,09	-21,99	-214,86	99,03
	2020	1,06	0,95	0,18	0,78	10,12	-3,22	-12,69	75,71
	2019	1,25	1,14	0,16	0,69	10,93	-7,68	-22,02	73,27

Source: Created by Authors.

The entropy values (ej) of the components are based on the weighted values, the degrees of differentiation (dj) of the components are based on the entropy values of the components and the degrees of significance (wj) of the components are based on the degrees of differentiation of the components are calculated. In this context, the entropy values, degrees of differentiation, and degrees of the significance of the defense industry companies registered in Borsa Istanbul (BIST) are indicated in Table 9. The results reveal that the criteria with the highest entropy weights for evaluating the financial performance of BIST-listed companies are Active Profitability Ratio (APR) and Equity Profitability Ratio (EPR). In the analyses made on a company basis, the following findings were obtained: EPR, APR, and CAR were discovered to be more significant in ASELS. In OTKAR and PAPIL companies, the degree of significance of Equity Profitability Ratio (EPR), Active Profitability Ratio (APR), and Stock Turnover Ratio (STT) criteria were found to be higher. In SDTTR, the degree of significance of Equity Profitability Ratio (EPR), Asset Turnover Ratio (AST), and Active Profitability Ratio (APR) criteria were determined to be higher. In KATMER and NETAŞ companies, Cash Ratio (CAR), Active Profitability Ratio (APR), and Equity Profitability Ratio (EPR) criteria were found to be more vital.

Table 9: Calculation of significance weights

	criters	**ej**	**dj**	**wj**	**ranking**
ASELS	**CUR**	0,8954	0,1045	0,0910	7
	LİR	0,8911	0,1088	0,0947	5
	CAR	0,8328	0,1671	0,1455	3
	AST	0,8922	0,1077	0,0938	6
	STT	0,8902	0,1097	0,0956	4
	APR	0,7781	0,2218	0,1931	2
	EPR	0,7740	0,2259	0,1967	1
	LER	0,8976	0,1023	0,0891	8
	criters	ej	dj	wj	ranking
OTKAR	**CUR**	0,8978	0,1121	0,1211	5
	LİR	0,8901	0,1098	0,1186	6
	CAR	0,8847	0,1152	0,1244	4
	AST	0,8951	0,1048	0,1132	7
	STT	0,8823	0,1176	0,1271	3
	APR	0,8684	0,1315	0,1420	2
	EPR	0,8672	0,1327	0,1433	1
	LER	0,8982	0,1017	0,1099	8
	criters	ej	dj	wj	ranking
PAPIL	**CUR**	0,8616	0,1383	0,0284	6
	LİR	0,8663	0,1363	0,0280	7
	CAR	0,8592	0,1407	0,0289	5
	AST	0,7661	0,2338	0,0480	4
	STT	0,7351	0,2648	0,0554	3
	APR	-1,1474	2,1474	0,4411	1
	EPR	-0,6858	1,6858	0,3463	2
	LER	0,8796	0,1203	0,0247	8

	criters	ej	dj	wj	ranking
SDTTR	**CUR**	0,8803	0,1196	0,0168	8
	LİR	0,8681	0,1318	0,0185	6
	CAR	0,8022	0,1977	0,0278	5
	AST	-0,6312	1,6312	0,2298	2
	STT	-0,6263	1,6263	0,2291	4
	APR	-0,6274	1,6274	0,2293	3
	EPR	-0,6367	1,6367	0,2306	1
	LER	0,8737	0,1262	0,0177	7
	criters	ej	dj	wj	ranking
NETAŞ	**CUR**	0,8877	0,1122	0,0265	7
	LİR	0,8858	0,1141	0,0269	6
	CAR	0,7871	0,2128	0,0502	3
	AST	0,8778	0,1221	0,0288	4
	STT	0,8851	0,1148	0,0271	5
	APR	-0,6886	1,6886	0,3987	2
	EPR	-0,7631	1,7631	0,4163	1
	LER	0,8932	0,1067	0,0252	8
	criters	ej	dj	wj	ranking
KATMER	**CUR**	0,8970	0,1029	0,0912	8
	LİR	0,8926	0,1073	0,0950	7
	CAR	0,7349	0,2650	0,2347	1
	AST	0,8894	0,1105	0,0978	6
	STT	0,8653	0,1346	0,1192	4
	APR	0,8534	0,1465	0,1298	2
	EPR	0,8572	0,1427	0,1264	3
	LER	0,8806	0,1193	0,1056	5

Source: Created by Authors.

TOPSIS Method Results

Normalizing the decision matrix is a crucial step in the analysis, and these operations are presented in the study's appendix under the section "TOPSIS Method Results." The normalized matrix was weighted using the Entropy method, and the results were displayed as the weighted decision matrix. Determining positive and negative ideal values requires classifying the criteria as benefit-oriented or cost-oriented. In this context, the criteria were categorized as benefit-oriented (CUR, LIR, CAR, AST, STT, APR, EPR) and cost-oriented (LER). The positive and negative distance values were calculated in the subsequent step, and the relative closeness was computed to establish the rankings. The positive ideal distance measures, negative ideal distance measures, and financial performance rankings are highlighted in Table 10.

Table 10: TOPSIS Method Results

ASELS	**Years**	**Sİ$^+$**	**Si$^-$**	**Ci**	**Ranking**
	2023	0,14931	0,271275213	0,6449939	4
	2022	0,173906	0,268648967	0,607040385	5
	2021	0,077041	0,266868808	0,775984018	3
	2020	0,042263	0,213162446	0,834540366	2
	2019	0,029044	0,156725074	0,843657252	1
OTKAR	**Years**	**Sİ$^+$**	**Si$^-$**	**Ci**	**Ranking**

	2023	0,084433	0,044244916	0,343842944	5
	2022	0,069235	0,051713442	0,427564925	4
	2021	0,045086	0,078769713	0,635980101	1
	2020	0,051947	0,068521086	0,568791464	3
	2019	0,048153	0,065580352	0,576613926	2
PAPIL	**Years**	**Sİ$^+$**	**Si$^-$**	**Ci**	**Ranking**
	2023	0,149588203	0,211034402	0,585194603	2
	2022	0,633407091	0,361343141	0,36325012	4
	2021	0,118384084	0,259828829	0,686990898	1
	2020	0,154586452	0,135466345	0,467040298	3
	2019	0,261998571	0,116218099	0,307279155	5
SDTTR	**Years**	**Sİ$^+$**	**Si$^-$**	**Ci**	**Ranking**
	2023	0,190682	0,139060627	0,421724536	4
	2022	0,152801	0,237941659	0,608946942	3
	2021	0,070039	0,273429074	0,796083155	1
	2020	0,08404	0,265190368	0,759356832	2
	2019	0,323251	0,00157652	0,0048534	5
NETAŞ	**Years**	**Sİ$^+$**	**Si$^-$**	**Ci**	**Ranking**
	2023	0,029628173	0,825006486	0,965332352	1
	2022	0,336528552	0,587195302	0,635682731	4
	2021	0,630338821	0,204951605	0,245365682	5
	2020	0,181691186	0,651509769	0,781935937	2
	2019	0,238865409	0,587107444	0,710807191	3
KATMER	**Years**	**Sİ$^+$**	**Si$^-$**	**Ci**	**Ranking**
	2023	0,14605844	0,313846098	0,682415745	3
	2022	0,140728602	0,27284395	0,659724511	4
	2021	0,057277853	0,341347793	0,856311671	1
	2020	0,162125631	0,273233489	0,627604836	5
	2019	0,058719955	0,338560679	0,852195273	2

Source: Created by Authors.

According to the financial performance rankings derived using the TOPSIS method, in 2023, NETAŞ (0.9653) had the highest financial performance, followed by KATMER (0.6824) and ASELS (0.6449). The companies with the lowest financial performance in 2023 were OTKAR (0.3438) and SDTTR (0.4217).

As of 2022, the companies with the highest financial performance were KATMER (0.6597), NETAŞ (0.6356), SDTTR (0.6089), and ASELS (0.6070), while the lowest performers were PAPIL (0.3632) and OTKAR (0.4275).

In 2021, when the effects of the COVID-19 pandemic were most pronounced, KATMER (0.8563), SDTTR (0.7960), and ASELS (0.7759) had the highest financial performance, while NETAŞ (0.2453) exhibited the lowest performance.

During the height of the pandemic in 2020, the top-performing companies were ASELS (0.8345), NETAŞ (0.7819), and SDTTR (0.7593), with the lowest financial performance recorded by PAPIL (0.4670) and OTKAR (0.5687).

In 2019, KATMER (0.8521), ASELS (0.8436), and NETAŞ (0.7108) demonstrated the highest financial performance, while SDTTR (0.0048) and PAPIL (0.3072) exhibited the lowest performance.

EDAS Method Results.

The financial performance of defense industry companies listed on Borsa Istanbul (BIST) has been evaluated using the EDAS method. In the EDAS method, the first step involves calculating the mean values for each component in the decision matrix, as presented in Table 8. The average positive and negative distance values must be calculated relative to these mean values. These average positive and negative distance values are provided in the appendix (EDAS Method Results). In the subsequent step, the average positive and negative distance values are multiplied by the weight assigned to each component to obtain the weighted positive and negative distance values, also revealed in the appendix.

The process continues by summing the component-based values in the weighted positive and negative distance matrices, resulting in SP (Positive Distance) and NP (Negative Distance) values. These SP and NP values are then normalized. The normalization of SP values (NSPi) is calculated by dividing each company's SP value by the maximum SP value across all companies. For NSNi, normalization is done by subtracting the ratio of each company's NP value from the maximum NP value by 1. In the final step, the performance scores for the alternatives are calculated, as highlighted in Table 11.

Based on the financial performance rankings obtained through the EDAS method in 2023, which follows the COVID-19 pandemic period, the companies with the highest financial performance were NETAŞ (0.9650) and PAPIL (0.8439). The companies with the lowest financial performance were KATMER (0.0867) and ASELS (0.0863).

In 2022, the highest financial performers were SDTTR (0.8478) and OTKAR (0.4843), while the companies with the lowest performance were PAPIL (0.0218), ASELS (0.0754), and NETAŞ (0.2549).

During 2021, a year when the effects of the COVID-19 pandemic were still pronounced, the highest financial performance was observed in SDTTR (0.9993), PAPIL (0.9952), OTKAR (0.9261), KATMER (0.7740), and ASELS (0.7734). The lowest performer was NETAŞ (0.0321), indicating that five defense industry companies listed on BIST had a solid financial performance that year.

In 2020, at the peak of the pandemic, the companies with the highest financial performance were SDTTR (0.9382), ASELS (0.8363), PAPIL (0.7507), and OTKAR (0.7181), while KATMER (0.0391) recorded the lowest financial performance.

In 2019, the highest financial performers were ASELS (0.9942), OTKAR (0.8912), and KATMER (0.7069), while the lowest performance was observed in SDTTR (0.00).

Table 11: EDAS Method Results

ASELS	**Years**	**SPi**	**SNi**	**NSPi**	**NSNi**	**ASi**	**Ranking**
	2023	0,006955551	0,341692	0,02197	0,150642136	0,086306086	4
	2022	0,047752999	0,402295	0,150834	0	0,075417114	5
	2021	0,246548129	0,093249	0,778755	0,768208407	0,773481802	3
	2020	0,218932279	0,007536	0,691527	0,981266528	0,836396688	2
	2019	0,316592595	0,004604	1	0,988556824	0,994278412	1
OTKAR	**Years**	**SPi**	**SNi**	**NSPi**	**NSNi**	**ASi**	**Ranking**
	2023	0,068727156	0,185642534	0,64338965	0	0,321694825	5
	2022	0,070638176	0,128556603	0,661279681	0,307504589	0,484392135	4
	2021	0,106820425	0,027414361	1	0,852327156	0,926163578	1
	2020	0,076537027	0,052017274	0,716501803	0,719798729	0,718150266	3
	2019	0,100745535	0,029837546	0,943129885	0,839274194	0,89120204	2
PAPIL	**Years**	**SPi**	**SNi**	**NSPi**	**NSNi**	**ASi**	**Ranking**
	2023	1,015291129	0,04115763	0,701241191	0,986617589	0,84392939	2
	2022	0,063296915	3,075501948	0,043717908	0	0,021858954	5
	2021	1,447848676	0,029488977	1	0,990411654	0,995205827	1
	2020	0,726210752	0	0,501579181	1	0,75078959	3
	2019	0,475738189	0,585020243	0,328582812	0,809780565	0,569181688	4
SDTTR	**Years**	**SPi**	**SNi**	**NSPi**	**NSNi**	**ASi**	**Ranking**
	2023	0,026599802	0,214854935	0,055118831	0,775051	0,415084698	4
	2022	0,415692065	0,158287583	0,86137711	0,834276	0,847826361	3
	2021	0,482590099	0,001289859	1	0,99865	0,99932477	1
	2020	0,441949021	0,037468321	0,915785511	0,960771	0,93827841	2
	2019	0	0,955125468	0	0	0	5
NETAŞ	**Years**	**SPi**	**SNi**	**NSPi**	**NSNi**	**ASi**	**Ranking**
	2023	1,595114	0,430725	1	0,930193	0,965097	1
	2022	0,115179	3,470034	0,072207	0,437617	0,254912	4
	2021	0,102455	6,170237	0,064231	0	0,032115	5
	2020	0,117321	1,247927	0,07355	0,797751	0,43565	2
	2019	0,127548	1,603706	0,079962	0,74009	0,410026	3
KATMER	**Years**	**SPi**	**SNi**	**NSPi**	**NSNi**	**ASi**	**Ranking**
	2023	0,043938284	0,249807934	0,173507521	0	0,086753761	4
	2022	0,044002397	0,125172883	0,173760697	0,498923508	0,336342102	3
	2021	0,253235615	0,112892224	1	0,548083915	0,774041957	1
	2020	0,008024691	0,238161219	0,031688637	0,04662268	0,039155658	5
	2019	0,217138372	0,110784767	0,857455901	0,556520222	0,706988062	2

Source: Created by Authors.

CoCoSo Method Result

As with the other methods used in this study, the CoCoSo method begins with the creation of the decision matrix, the formation of which is illustrated in Table 8 under the Entropy Method section. The normalization of the decision matrix for benefit- and cost-oriented criteria was carried out using Equations (18) and (19), and the results are offered. After normalization using the CoCoSo method, the third step involved calculating the Si values using Equation (20). After calculating Si values, the Pi values were determined using Equation (21), and these results are displayed in Table 12. In the fourth step of the CoCoSo method, kia, kib, and kic values were

calculated using Equations (21), (22), and (23). Finally, in the last step, the *ki* value, used to rank the financial performance of defense industry companies listed on BIST, was calculated using Equation (24); the results are demonstrated in Table 12.

According to the financial performance rankings obtained using the CoCoSo method, in 2023, following the COVID-19 pandemic, the companies with the highest financial performance were SDTTR (38.317), NETAŞ (7.497), and PAPIL (4.697). The companies with the lowest financial performance were OTKAR (1.647) and ASELS (1.312).

In 2022, the highest financial performers were SDTTR (58.093) and NETAŞ (4.953), while the companies with the lowest financial performance were PAPIL (2.584), KATMER (2.100), ASELS (2.015), and OTKAR (1.582).

In 2021, a year when the effects of the COVID-19 pandemic were still significant, the companies with the highest financial performance were SDTTR (65.614) and PAPIL (4.874). In contrast, those with the lowest performance were KATMER (2.927), ASELS (2.780), OTKAR (2.345), and NETAŞ (1.610).

In 2020, at the peak of the pandemic, the highest-performing companies were SDTTR (59.661), NETAŞ (7.007), PAPIL (5.020), and ASELS (3.312), while the companies with the lowest financial performance were OTKAR (1.574) and KATMER (0.859).

In 2019, the highest financial performers were NETAŞ (6.278), ASELS (3.481), and KATMER (3.009), while the lowest-performing companies were OTKAR (2.397), PAPIL (2.136), and SDTTR (0.995).

Table 12: CoCoSo Method Results

ASELS	**Years**	**S_i**	**P_i**	**K_{ia}**	**K_{ib}**	**K_{ic}**	**K_i**	**Ranking**
	2023	0,195811	3,356322401	0,112754787	2	0,437504744	1,312165175	5
	2022	0,279631	5,335697761	0,178246452	3,01781045	0,691621799	2,015110836	4
	2021	0,518061	6,240409224	0,214533005	4,50501748	0,832418829	2,780716147	3
	2020	0,627155	7,351362148	0,253260746	5,3931582	0,982688019	3,312787125	2
	2019	0,767713	6,831010916	0,24120501	5,95594209	0,935910033	3,481400762	1
OTKAR	**Years**	**S_i**	**P_i**	**K_{ia}**	**K_{ib}**	**K_{ic}**	**K_i**	**Ranking**
	2023	0,362378	5,260153768	0,177960329	2,12236391	0,708357052	1,64725849	3
	2022	0,409428	4,691466217	0,161449845	2,13086051	0,642638374	1,58298812	4
	2021	0,548686	7,294171647	0,248236482	3,07049002	0,988085734	2,34542512	2
	2020	0,403914	4,686673996	0,161123644	2,11462218	0,641339957	1,57468124	5
	2019	0,57679	7,360635932	0,251229699	3,16222685	1	2,39731641	1
PAPIL	**Years**	**S_i**	**P_i**	**K_{ia}**	**K_{ib}**	**K_{ic}**	**K_i**	**Ranking**
	2023	0,71	7,63	0,24719919	9,00101921	0,96942743	4,69794788	3
	2022	0,15	5,92	0,18000427	4,39672894	0,70591284	2,58449123	4
	2021	0,78	7,63	0,2491436	9,43941176	0,97705273	4,87478827	2
	2020	0,81	7,79	0,25499504	9,74216602	1	5,02006466	1
	2019	0,57	1,74	0,0686579	4,74047378	0,26925189	2,13697248	5
SDTTR	**Years**	**S_i**	**P_i**	**K_{ia}**	**K_{ib}**	**K_{ic}**	**K_i**	**Ranking**
	2023	0,454619	7,332806	0,24129	105,205219	0,92269	38,3176	4

	2022	0,714095	7,625677	0,25841	162,644483	0,98814	58,0934	3
	2021	0,814208	7,580842	0,26012	184,700373	0,99469	65,614	1
	2020	0,750964	5,503185	0,19378	169,356388	0,74102	59,661	2
	2019	0,004533	1,492935	0,0464	2	0,17743	0,99568	5
NETAŞ	**Years**	**S_i**	**P_i**	**K_{ia}**	**K_{ib}**	**K_{ic}**	**K_i**	**Ranking**
	2023	0,883957	4,941036045	0,177514211	17,750391	0,686054627	7,497657426	1
	2022	0,510166	5,279391643	0,176434329	10,7357768	0,681881112	4,953732183	4
	2021	0,052772	5,574394636	0,171485553	2,12818336	0,662755149	1,610534725	5
	2020	0,716838	7,60661024	0,253653585	15,1230736	0,980317096	7,007415502	2
	2019	0,649877	6,599191901	0,220912322	13,6503171	0,853779085	6,278910915	3
KATMER	**Years**	**S_i**	**P_i**	**K_{ia}**	**K_{ib}**	**K_{ic}**	**K_i**	**Ranking**
	2023	0,451162	5,669206873	0,210223397	4,86578	0,846899114	2,26306732	3
	2022	0,417205	5,406168841	0,200022173	4,55942	0,805802795	2,10004337	4
	2021	0,608185	6,439515939	0,242075544	6,1193	0,975217635	2,92707339	2
	2020	0,161588	2,7338126	0,099451685	2	0,40064781	0,8599299	5
	2019	0,616279	6,610518393	0,248227201	6,23195	1	3,00903873	1

Source: Created by Authors.

The financial performance rankings for 2019-2023 were calculated using the TOPSIS, EDAS, and CoCoSo methods, and the results were compared in Table 13. The following findings were obtained from the analyses:

ASELS Company: According to evaluations made with the TOPSIS, EDAS, and CoCoSo methods, ASELS demonstrated high financial performance in 2019, 2020, and 2021. However, performance declined in 2022 and 2023. This consistency across the methods indicates alignment in the assessment criteria of ASELS's performance.

OTKAR Company: Based on the TOPSIS and EDAS methods, OTKAR's financial performance was strong in 2021, 2019, and 2020. The CoCoSo method also identified high performance in 2019 and 2023. In contrast, TOPSIS and EDAS indicated that OTKAR's performance was lower in 2023 and 2022, while CoCoSo pointed to 2022 and 2020 as periods of weaker performance. These findings highlight fluctuations in OTKAR's financial performance across the years.

PAPIL Company: According to the TOPSIS and EDAS methods, PAPIL exhibited strong financial performance in 2021, 2023, and 2020. The CoCoSo method similarly identified high performance in 2020, 2021, and 2023. However, all methods agreed that PAPIL'S financial performance was weaker in 2022 and 2019, indicating sustained declines in these years.

SDTTR Company: The analyses conducted using the TOPSIS, EDAS, and CoCoSo methods revealed that SDTTR's financial performance was strong in 2021, 2020, and 2022, while weaker performance was observed in 2023 and 2019. These results indicate a consistent trend across the methods used to evaluate SDTTR's performance.

NETAŞ Company: According to the TOPSIS, EDAS, and CoCoSo methods, NETAŞ displayed high financial performance in 2023, 2020, and 2019, with a decline in performance in 2022 and 2021. The consistency of these

findings across all methods indicates general alignment in assessing NETAŞ's performance.

KATMER Company: The EDAS and TOPSIS methods identified solid financial performance for KATMER in 2021 and 2019, while the CoCoSo method found high performance in 2019 and 2021. All three methods agreed that KATMER's financial performance in 2020 was low, ranking fifth. This finding highlights the negative impact of the pandemic on KATMER's performance.

Table 13: General Ranking Results

		TOPSIS	EDAS	COCOSO
ASELS	**Years**	**Ranking**	**Ranking**	**Ranking**
	2023	4	4	5
	2022	5	5	4
	2021	3	3	3
	2020	2	2	2
	2019	1	1	1
OTKAR	**Years**	**Ranking**	**Ranking**	**Ranking**
	2023	5	5	3
	2022	4	4	4
	2021	1	1	2
	2020	3	3	5
	2019	2	2	1
PAPIL	**Years**	**Ranking**	**Ranking**	**Ranking**
	2023	2	2	3
	2022	4	5	4
	2021	1	1	2
	2020	3	3	1
	2019	5	4	5
SDTTR	**Years**	**Ranking**	**Ranking**	**Ranking**
	2023	4	4	4
	2022	3	3	3
	2021	1	1	1
	2020	2	2	2
	2019	5	5	5
NETAŞ	**Years**	**Ranking**	**Ranking**	**Ranking**
	2023	1	1	1
	2022	4	4	4
	2021	5	5	5
	2020	2	2	2
	2019	3	3	3
KATMER	**Years**	**Ranking**	**Ranking**	**Ranking**
	2023	3	4	3
	2022	4	3	4
	2021	1	1	2
	2020	5	5	5
	2019	2	2	1

Conclusion and Recommendations

The defense industry is pivotal in fostering economic mobility and, more crucially, driving sustainable economic growth. The future trajectory of the defense sector is intricately linked to its ability to sustain competitiveness in a globally competitive environment. The Turkish defense industry, witnessing a marked increase in its global standing, occupies a strategic position in Turkey's economic advancement. This sector contributes significantly to high value-added production, the cultivation of a skilled workforce, and advancements in technological development. The continuous momentum in the development of Turkey's defense industry underscores the nation's substantial achievements and innovations in this field.

This study comprehensively examines the impact of the COVID-19 pandemic on the financial performance of companies operating in the defense industry, focusing on the period from 2019 to 2023. The significance levels of the criteria were calculated using the Entropy method, one of the objective criteria weighting techniques. The TOPSIS, EDAS, and CoCoSo evaluations revealed significant fluctuations in the companies' financial performance, demonstrating that the pandemic had particularly adverse effects in specific years.

ASELS exhibited solid financial performance during 2019-2021; however, a decline in 2022 and 2023 suggests that post-pandemic uncertainties harmed the company. Similarly, companies like OTKAR and PAPIL experienced high performance in specific years but saw a weakening, particularly in 2022 and 2023. These findings indicate that the pandemic had widespread effects across the sector. Fluctuations were also observed in the performance of SDTTR and NETAŞ, while KATMER's significant decline in 2020 highlights the pandemic's impact.

This study is significant because it underlines the necessity of analyzing the financial performance of companies in strategic sectors, such as the defense industry, during periods of crisis like the pandemic. These analyses assess past performance and emphasize the need for strategic decision-making to enhance resilience against potential future crises.

In this context, several recommendations can be made for companies. Sources of income should be diversified by adapting defense technologies to civilian sectors and by focusing on international markets. It is critical to use derivative instruments (hedging) against foreign exchange risk and to reduce vulnerabilities in the supply chain with alternative sources. Adequate cash reserves should be established for crisis periods and long-term fixed interest financing methods should be preferred. Fixed costs should be reduced, flexible cost structures should be adopted and the business should be adapted to crises. Digital transformation in defense technologies should be accelerated, and solutions that can be used in both military and civilian areas should be developed. Various researches can be conducted to increase the resilience of defense industry companies to crises. For example, the effects of revenue diversification and supply chain strategies, financial resilience factors, and the effectiveness of

instruments used against foreign exchange and interest rate risks can be analyzed. In addition, the impact of financial planning and government support policies can be analyzed through crisis simulations. A new study can be conducted to analyze the financial performance of different sectors and businesses during the COVID-19 period using updated Multi-Criteria Decision-Making (MCDM) methods.

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