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FINANCIAL PERFORMANCE DETERMINATION WITH COPRAS AND MOORA METHODS: AN APPLICATION IN BIST PAPER AND PAPER PRODUCTS PRINTING SECTOR

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Abstract

Businesses, which provide the production and mediation of goods and services needed by society, are organizations that have goals such as growth, development, making a profit, establishing a sustainable structure, and realizing social responsibility projects. Businesses need to have a financially strong structure in order to achieve their goals. In order to establish a sustainable financial structure, analyzes are carried out with various methods using the historical data of the enterprise, and future decisions are taken with these analysis outputs. One of the financial sustainability measures for businesses is performance measurement. In many academic studies in the literature, it is observed that Multi-Criteria Decision Making (MCDM) methods are used for financial performance measurement. With MCDM methods, companies are compared financially within themselves, by years, and with the sector. This study was carried out to measure the financial performance of businesses operating in the BIST Paper and Paper Products Printing Sector. As a sample, the data of 9 companies operating in the BIST Paper and Paper Products Printing Sector were used. The financial ratios of the enterprises for the years 2016-2021 were obtained and the analysis was carried out with COPRAS and MOORA, which are MCDM methods. Using two analysis methods provides the opportunity to evaluate financial performance rankings from different perspectives. As a result of the study, the financial performance rankings of 9 companies in the sector were evaluated according to both methods.

Keywords: COPRAS, MOORA, BIST, Paper and Paper Products Printing, Financial Performance.

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COPRAS ve MOORA Yöntemleri ile Finansal Performans Tespiti: BIST Kâğıt ve Kâğıt Ürünleri Basım Sektöründe Bir Uygulama

Öz

İşletmeler, toplumun ihtiyaç duyduğu mal ve hizmetlerin üretimi ile aracılığını sağlayan; büyüme, gelişme, kâr sağlama, sürdürülebilir bir yapı kurma, sosyal sorumluluk projeleri gerçekleştirme gibi amaçlara sahip olan kuruluşlardır. İşletmelerin amaçlarına ulaşabilmeleri için finansal olarak güçlü bir yapıya sahip olmaları önem arz etmektedir. Sürdürülebilir finansal yapı kurulabilmesi amacıyla işletmeler, geçmiş verileri kullanılarak çeşitli yöntemlerle analizler gerçekleştirilmekte ve geleceğe yönelik kararlar bu analiz çıktılarıyla alınmaktadır. İşletmeler için finansal sürdürülebilirlik ölçülerinden biri de performans ölçümüdür. Literatürde gerçekleştirilen birçok akademik çalışmada, finansal performans ölçümü için Çok Kriterli Karar Verme (ÇKKV) yöntemlerinin kullanıldığı gözlemlenmektedir. ÇKKV yöntemleri ile işletmelerin finansal olarak kendi içerisinde, yıllar itibariyle ve sektörle karşılaştırılması sağlanmaktadır. Bu çalışma, BIST Kâğıt ve Kâğıt Ürünleri Basım Sektöründe faaliyet gösteren işletmelerin finansal performansının ölçümünün sağlanması amacıyla gerçekleştirilmiştir. Örneklem olarak BIST Kâğıt ve Kâğıt Ürünleri Basım Sektöründe faaliyet gösteren 9 işletmenin verileri kullanılmıştır. İşletmelerin 2016-2021 yılları finansal oranları elde edilerek, ÇKKV yöntemlerinden olan COPRAS ve MOORA ile analiz gerçekleştirilmiştir. İki yöntem kullanılarak analiz yapılması, finansal performans sıralamalarını farklı bakış açıları ile değerlendirme imkânı sağlamaktadır. Çalışma sonucunda, sektörde yer alan 9 işletmenin finansal performans sıralaması her iki yönteme ve yıllara göre yapılarak değerlendirmelerde bulunulmuştur.

Anahtar Kelimeler: COPRAS, MOORA, BIST, Kâğıt ve Kâğıt Ürünleri Basım, Finansal Performans.

Introduction

Financial performance is the name given to the process carried out in order to statistically measure the activities of the enterprises in certain periods and to make future decisions based on the past data of the enterprise as a result of these measurements. In performance measurement, data obtained from financial statements such as balance sheets and income statements of enterprises are used. As a result of the calculations, the data obtained about the current status of the enterprise are compared with standard indicators and the resulting quantitative information is shared with managers, stakeholders and interested parties. Thanks to financial performance measurement, businesses are also protected from the risk of financial failure by making strong decisions for the future. In order to establish a sustainable

financial structure, financial performance measurement also enables the establishment of standard indicators by comparing the business with other businesses. (Mercan and Çetin, 2019, p.125).

Various methods are used for financial performance measurement. Today, it is not possible to measure the financial performance and success of businesses using only financial ratios. For this reason, it is important to use statistical methods developed to measure the financial performance of companies. In the measurement of financial performance, Multi-Criteria Decision Making (MCDM) methods are frequently used in the literature (Saldanlı and Sırma, 2014, p. 186). (MCDM) methods include very useful methods in terms of considering more than one alternative and making evaluations between criteria. MCDM methods determine the immeasurability and incomparability situations among the alternatives and provide a solution. MCDM methods, which enable decision-makers to make selection decisions by using multiple criteria, are also preferred due to their usefulness (Topak and Çanakçıoğlu, 2019, p. 110-111). When we look at the existing MCDM methods in the literature, it is seen that there are many methods created with different equations and perspectives. The most used of these methods can be listed as Analytical Hierarchy Process (AHP), Analytical Network Process (ANP), DEMATEL, TOPSIS, VIKOR, PROMETHEE, ELECTRE, COPRAS, Gray Relational Analysis (GRA) and MOORA. When the existing methods in the literature are examined, it is that after the determination of the criteria, the use of the most suitable model for the current assumptions is effective in deciding to make the selection most accurately. Each method has steps and after the applied steps, the most appropriate solution is obtained according to the methods (Dinçer and Yüksel, 2018, p. 2-3).

MCDM methods which were used in decision making are frequently preferred for financial performance measurement in the literature. The inadequacies in the use of financial ratios for performance measurement, the difficulties in making

decisions for the future based on the past data of the enterprises, and the inconsistencies arising from the differences in the methods have increased the frequency of the use of MCDM methods in the field of finance. This study was carried out in order to measure the financial performance of enterprises operating in the BIST Paper and Paper Products Printing Sector by using MCDM methods. In the literature, Akyüz et al. (2018), Akyüz and Yıldırım (2019), Yılmaz and Erdoğan (2020), Sel and Zengin (2020), Kurt et al. (2021), it is seen that the authors carried out studies for the sector and carried out financial performance measurement. In the studies, the situation of the enterprises in the sector was evaluated based on different years and methods. It is expected that this study will contribute to the literature in terms of including up-to-date data and a mutual evaluation of the two methods. It is expected that the study will contribute to the evaluation of the findings obtained from the study together. The content of the study consists of the literature review, the methodology of the study, analysis and findings, and conclusion and evaluation sections following the introduction. In the literature review section, there are academic studies carried out in order to reveal the financial performance and status of the enterprises in the relevant sector. In the methodology part of the study, COPRAS and MOORA methods are explained with equations. In the analysis and findings section, there are MCDM methods used in the study and the findings obtained as a result of the application of the methods. In the conclusion part, there are evaluations and suggestions in line with the findings.

1. Literature Review

Financial performance ensures that the right decisions are taken for the future based on the historical data of the enterprises. It is observed that Multi-Criteria Decision Making (MCDM) methods are frequently used in the measurement of financial performance. Academic studies carried out to determine the current situation by analyzing the financial status of enterprises operating in the BIST Paper and Paper Products Printing Sector are listed below.

Akyüz et al. (2017) conducted a study on the financial performance of enterprises operating in the BIST Paper and Paper Products sector. In the study, various tests were carried out with ratio analysis using the data of 7 enterprises operating between 2010-2015. As a result of the study, the financial performances of the enterprises were evaluated and interpreted in comparison with the standard indicators. It has been observed that the liquidity ratios of all companies decreased significantly in 2014-2015, the ratios were considerably higher than the sector average in 2010-2013, and the liquidity ratios remained below the average in 2014 and 2015. It has been determined that the financial leverage ratios of the companies are below the sector average and generally accepted averages for all years. When the activity ratios are analyzed, it is seen that the relationship between assets and sales tends to increase; therefore, it is stated that the companies use their assets efficiently.

Akyüz et al. (2018) conducted a study to determine the financial performance of enterprises in the BIST Paper and Paper Products Printing and Publishing sector. In the study, analysis was carried out with TOPSIS, PROMETHEE and COPRAS methods on 14 enterprises operating from 2012-2017. As a result of the study, financially successful and unsuccessful businesses were determined according to the methods and comparative evaluations were made. Within the framework of the determined ratios, it has been determined that the financial performances of the companies according to the TOPSIS method and the PROMETHEE method give similar results, while the COPRAS method shows different results from other methods between 2013 and 2017. In all three methods used in 2016, it was determined that the financial performance of the DGZTE company was the best and the HURGZ company was the worst. In all three methods used in 2016, it was determined that the financial performance of the DGZTE company was the best and the HURGZ company was the worst.

Akyüz and Yıldırım (2019) conducted a study to determine the relationship between the financial ratios and firm values of enterprises operating in the Paper and

Paper Products sector. In the study, data from 7 companies between 2012-2018 and panel data analysis were used. As a result of the study, financial ratios and statistical relations that have a significant effect on firm value were determined and evaluations were made. According to the results obtained, the liquidity ratios are 25.7%, activity rates are 38.3%, and financial structure ratios are 41.4%, on the other hand, it has been determined that the profitability ratios are explanatory of the firm value at the level of 33%. When all the ratios are evaluated together, the explanatory level of the firm value of these ratios is 82%.

Yılmaz and Erdoğan (2020) conducted a study to determine the financial performance of enterprises operating in the Forestry, Paper and Printing sectors. In the study, the analysis was carried out with the TOPSIS method, using the data for the period of 2014-2018. According to the findings, as a result of weighting with the ratio method, it was stated that the first 3 enterprises did not change in the 2014-2016 period, there were differences in other years and according to the equally weighted results, only the PRZMA enterprise remained in place.

Akyüz et al. (2020) conducted a study to evaluate the financial performance of enterprises operating in the paper and paper products sector. In the study, businesses in the relevant sector between the years 2012-2018 were examined with Dupont Analysis. Also, success ranking was made based on Dupont values and evaluations were made. As a result of the analysis made according to Dupont ratios, Alkim firm (0.414%) ranks first, Kartonsan firm ranks second (0.126%), and Tire Kutsan (0.096%) firm ranks third. Considering the average of seven years according to asset turnover and equity multiplier values, it is that Alkim company ranks first.

Apan and Öztel (2020) conducted a study on businesses traded in the BIST Forest Paper Printing Index. In the study, the Integrated Entropy-EDAS method was used and analysis was carried out with 12 financial ratios of 15 companies traded in the index between 2011-2018. As a result of the study, it was stated that KARTN enterprise was the most successful company except for 2015, while GENTS

enterprise took second place and SAMAT and HURGZ enterprises were also in the last place.

Sel and Zengin (2020) conducted a study to determine the financial performance of enterprises operating in the paper and paper products sector. In the study, the TOPSIS method was used and various tests were carried out with the data from 12 enterprises between 2014-2018. According to the findings, it was stated that Doğan and Prizma businesses were successful in terms of financial performance, while BAKAB and Olmuksan businesses were unsuccessful.

Kurt et al. (2021), carried out a study to measure the financial performance of enterprises operating in the paper products, forest products and furniture sectors. In the study, the analysis was carried out with the PROMETHEE method using data from 15 enterprises. As a result of the study, it was found that ALKA and SUMAS businesses showed the best performance before and after the pandemic.

Karadeniz et al. (2021), carried out a study to test the financial performance of enterprises in the paper and paper products sector. In the study, using the data between 2009-2019, analyzes were carried out with ratio analysis, Altman Z score and Springate models. As a result of the study, it has been found that the growth of the scale of the enterprises increases the liquidity, financial structure and profitability performances and reduces the risk of financial failure.

Akyüz and Yıldırım (2021) carried out a study to measure the financial performance of enterprises operating in the paper and paper products industry. In the study, analysis was carried out using the Tobin Q method with the data of 7 companies between the years 2012-2019. As a result of the study, it was stated that the relevant values of the 4 companies were above the standards and that the sector had financial success in general. Another finding obtained from the study is that the Paper and Paper Products industry sector has a suitable investment environment for investors, except for 2018.

Önem (2022) conducted a study to determine the cointegration and causality relationship between the BIST Forest Paper Printing index and various variables. In the study, Engle Granger cointegration and Granger causality tests were applied to the data between 2015-2021. As a result of the study, the cointegration and causality relations between the BIST Forest Paper Printing index and the variables were determined and interpreted. Engle Granger cointegration relationship was found with BIST Forest Paper Printing index and European forest-paper indices Helsinki Forestry & Paper and Stockholm Forestry & Paper indexes. At the same time, Engle Granger cointegration relationship was determined between BIST Forest Paper Printing index and Euro, Dollar and Sterling. However, a cointegration relationship with Futures Lumber Transactions could not be determined.

Kendirli and Çıtak (2022) conducted a study to determine the financial failures of businesses operating in the BIST Forest, Paper and Printing Index. In the study, the data between the years 2016-2020 and the Altman Z Score model were analyzed. As a result of the study, it was concluded that 7 of the 15 companies had a high risk of bankruptcy.

When the academic studies in the literature are evaluated in general, it is seen that the financial status and performance of the enterprises operating in the sector are evaluated with the information obtained from data sources such as the balance sheet and income statement of the enterprises operating in the BIST Paper and Paper Products Printing Sector. In the academic studies carried out, data from different years were used and mainly financial ratios were used. Considering the analysis types used in the studies, it is observed that methods such as TOPSIS, PROMETHEE, COPRAS, MOORA, Dupont Analysis, Altman Z Score Model, Tobin Q, and Springate S Score are used. When the results of the studies are examined, it is found that the financial performances of the enterprises are determined according to the methods used and evaluations and suggestions for the enterprises are made. When the results obtained from the studies are considered, it is observed that the companies with the best or the worst financial performance in

the studies vary according to the years. The reason for this situation can be explained as the determination of financial ratios and weights. The reason for the changes in the financial success of the companies is the strategies followed by the companies financially.

2. Methodology of the Study

Multi-Criteria Decision Making methods are frequently used in the measurement of financial performance. Among the MCDM methods, there are methods such as AHP, ANP, DEMATEL, TOPSIS, VIKOR, PROMETHEE, ELECTRE, COPRAS, GRA and MOORA. The methods differ in terms of calculation and the aim is to find the best alternative as a common feature.

In this study, COPRAS and MOORA from MCDM methods were used. The steps of the methods used are explained in this section. The COPRAS (Complex Proportional Assessment) method is a method developed by Zavadskas and Kaklauskas in 1996 and is used to evaluate criteria such as benefit and cost, to select the most appropriate alternative, or to measure performance as included in the study (Sarıçalı and Kundakcı, 2016). The application steps of the COPRAS method are as follows:

A_i: i. alternative, i=1,2,3,…,m

K_j: j. evaluation criteria, j=1,2,3,…,n

w_j: j. weight of evaluation criteria, j=1,2,3,…,n

x_{ij}: j. for evaluation criteria i. value of alternative

Stage 1: In the first stage, the decision matrix is created. Creating a decision matrix is included in Equation 1.

$$D = \begin{matrix} A_1 \\ \vdots \\ A_m \end{matrix} \begin{bmatrix} X_{11} & \cdots & X_{1n} \\ \vdots & \ddots & \vdots \\ X_{m1} & \cdots & X_{mn} \end{bmatrix} \quad \textbf{(1)}$$

Stage 2: The second stage of the method creates a normalized decision matrix. Equation 2 contains the relevant calculation.

$$X_{ij}^{*} = \frac{X_{ij}}{\sum_{i=1}^{m} X_{ij}} \quad \forall_j = 1,2,3,\dots,n \tag{2}$$

Stage 3: After the normalized decision matrix is created, the weighted decision matrix is created. The formula applied to create a weighted decision matrix is included in Equation 3.

$$D' = d_{ij} = X_{ij}^{*} \,.\, w_j \tag{3}$$

Stage 4: Benefit and cost criteria in the method are shown as S_i^{+} and S_i^{-}, and are calculated with the formulas in Equation 4 and Equation 5.

$$S_i^{+} = \sum_{j=1}^{k} d_{ij} \qquad j= 1,2,3,\dots,k \text{ (utility)} \tag{4}$$

$$S_i^{-} = \sum_{j=k+1}^{n} d_{ij} \qquad j=k+1, k+2, k+3, \dots, n \text{ (cost)} \tag{5}$$

Stage 5: Q_i values expressing the relative importance values are calculated as in Equation 6.

$$Q_i = S_i^{+} + \frac{\sum_{i=1}^{m} S_i^{-}}{S_i^{-} \cdot \sum_{i=1}^{m} \frac{1}{S_i^{-}}} \tag{6}$$

Stage 6: Reaching the maximum value to choose between the calculated Q_i values or to perform performance ranking is done with the help of Equation 7.

$$Q_{max} = max\{Q_i\} \qquad \forall_i = 1,2,3,\dots,m \tag{7}$$

Stage 7: P_i values calculated to perform sorting among alternatives are calculated with the help of Equation 8.

$$P_i = \frac{Q_i}{Q_{max}} \,.\, 100\% \tag{8}$$

The COPRAS method is carried out with the 7 steps above and the necessary ranking or criteria can be selected. Another method used in the study, MOORA (Multi-Objective Optimization on the basis of Ratio Analysis), is the MCDM method, which was introduced to the literature by Brauers and Zavadskas (2006) and provides the opportunity to choose between different alternatives (Özbek and Erol, 2016). Although the MOORA method has different techniques, the ratio method was used in the study. The steps of the method are shown below through equations.

The first three stages of the MOORA method are the same as the COPRAS method, but the differential equation is shown below. After applying normalization and weighted normalization operations to the decision matrix according to the MOORA method, the benefit and cost values of the criteria, namely each other, are subjected to the formula in Equation 9. Relevant rankings are performed with the help of the values obtained as a result of the equation.

$$y_i^* = \sum_{j=1}^{g} X_{ij}^* - \sum_{j=g+1}^{n} X_{ij}^* \quad \textbf{(9)}$$

3.Analysis and Findings

This study was carried out to determine the financial status of businesses operating in the BIST Paper and Paper Products Printing Sector. There are 12 enterprises in the sector. Within the scope of the study, data between the years 2016-2021 were used. 3 of the enterprises in the Paper and Paper Products Printing sector were excluded from the sample due to the lack of data for the years 2016-2020. Businesses not included in the data set are *BARMA*, *TEZOL* and *KONKA*. In order to ensure integrity in the study and to handle the data in the same period, the study continued with 9 enterprises. The businesses in the BIST Paper and Paper Products Printing Sector are listed in Table 1:

Table 1. *BIST Paper and Paper Products Printing Sector*

Number	Company
1	ALKA
2	BAKAB
3	***BARMA***
4	DURDO
5	***TEZOL***
6	KAPLM
7	KARTN
8	***KONKA***
9	MNDTR
10	PRZMA
11	SAMAT
12	VKING

Source: (Public Disclosure Platform, 2022)

COPRAS and MOORA methods were used for financial performance measurement. The financial ratios for which MCDM methods were applied in the study are given in Table 2:

Table 2. *Financial Ratios Used in the Study*

Financial Ratios	Formulas	Code	Utility-Cost
Current Rate	Current Assets/ Short-Term Liabilities	FR1	Utility
Cash Ratio	Cash and Cash Equivalents/Short-Term Liabilities	FR2	Utility
Liquidity Rate	(Current Assets-Inventories) / Short-Term Liabilities	FR3	Utility
Assets Turnover Rate	Net Sales/Average Assets	FR4	Utility
Equity Profitability Ratio	Net Profit/ Average Equity	FR5	Utility
Inventories Turnover Rate	Cost of Sales/Average Stocks	FR6	Utility
Assets Profitability Ratio	Net Profit/ Average Assets	FR7	Utility
Leverage Ratio	Total Liabilities/Total Assets	FR8	Cost

The financial ratios and codes used in the COPRAS and MOORA methods applied for financial performance measurement are given in Table 2. The companies in the BIST Paper and Paper Products Printing Sector and used as samples in the study were analyzed by COPRAS and MOORA methods. The methods were applied to the data of 9 enterprises between the years 2016-2021. In the study, only the analysis results of the ALKA enterprise are shown separately in order to set an example for the two methods applied to 9 enterprises. The methods applied to the ALKA enterprise were also applied to other enterprises. At the end of the method applications, the financial performance results of all enterprises were reported. In the first stage of the study, the results of the COPRAS method are shown. The decision matrix of the ALKA enterprise with the COPRAS method is given in Table 3:

Table 3. *Decision Matrix*

Years	**Utility**							**Cost**
	FR1	**FR2**	**FR3**	**FR4**	**FR5**	**FR6**	**FR7**	**FR8**
2021	2,60	1,25	2,08	1,63	66,44	6,52	42,79	39,30
2020	3,63	1,51	2,82	1,50	45,07	6,24	31,47	28,39
2019	3,04	1,48	2,52	1,69	28,38	6,27	19,32	32,38
2018	3,03	1,03	1,99	1,78	33,9	5,45	23,87	31,42
2017	3,40	1,53	2,46	1,36	21,69	6,06	15,79	27,32
2016	3,58	1,78	2,93	1,04	21,45	5,86	15,63	27,12
Weight	0,13	0,13	0,13	0,13	0,05	0,13	0,05	0,25

When the financial ratios of the ALKA business are analyzed within the scope of the study, it is observed that the current ratio, cash ratio and liquidity ratio decreased in 2021 compared to 2016, but above the standard indicators. In 2021, there is a decrease in the asset turnover rate and an increase in the stock turnover rate compared to 2016. Again in 2021, it is seen that the equity and return on assets increased. This situation is also considered positive. The leverage ratio increased in 2021 compared to 2016.

Table 3 shows the decision matrix. The reason why the weights are not determined equally in creating the decision matrix, which is the first step of the method, is that it differentiates the effects of financial ratios. According to the COPRAS method, financial ratios were separated as benefits and costs, and the weights were made by considering this distinction. The results of normalizing the decision matrix, which is the second step of the method, are available in Table 4:

Table 4. *Normalized Decision Matrix*

Years	FR1	FR2	FR3	FR4	FR5	FR6	FR7	FR8
2021	0,134855	0,145688	0,140541	0,181111	0,306274	0,1791209	0,287432	0,21137
2020	0,188278	0,175991	0,190541	0,166667	0,207763	0,1714286	0,211392	0,152692
2019	0,157676	0,172494	0,17027	0,187778	0,130826	0,1722527	0,129778	0,174152
2018	0,157158	0,120047	0,134459	0,197778	0,156272	0,1497253	0,160341	0,168988
2017	0,176349	0,178322	0,166216	0,151111	0,099986	0,1664835	0,106066	0,146937
2016	0,185685	0,207459	0,197973	0,115556	0,09888	0,160989	0,104991	0,145861

Table 4 shows the normalized decision matrix. After the performed stage, the results of creating the weighted normalized decision matrix, which is the third stage of the COPRAS method, are given in Table 5:

Table 5. *Weighted Normalized Decision Matrix*

Years	FR1	FR2	FR3	FR4	FR5	FR6	FR7	FR8
2021	0,017531	0,018939	0,01827	0,023544	0,015314	0,0232857	0,014372	0,052842
2020	0,024476	0,022879	0,02477	0,021667	0,010388	0,0222857	0,01057	0,038173
2019	0,020498	0,022424	0,022135	0,024411	0,006541	0,0223929	0,006489	0,043538
2018	0,02043	0,015606	0,01748	0,025711	0,007814	0,0194643	0,008017	0,042247
2017	0,022925	0,023182	0,021608	0,019644	0,004999	0,0216429	0,005303	0,036734
2016	0,024139	0,02697	0,025736	0,015022	0,004944	0,0209286	0,00525	0,036465

Table 5 shows the results of applying the weighted normalized decision matrix, which is the third stage of the COPRAS method. The results of the S_i^+ and S_i^- values for the useful criteria and the cost criterion, which are the next stage of the COPRAS method, are given in Table 6:

Table 6. S_i^+ *and* S_i^- *Values*

Years	S_i^+	S_i^-
2021	0,131256	0,052842
2020	0,137035	0,038173
2019	0,124891	0,043538
2018	0,114522	0,042247
2017	0,119305	0,036734
2016	0,12299	0,036465

The calculation of the Q_i values, which is the next step of the method, is available in Table 7. Q_i values and relative importance values were calculated, and the results were reported in the table below:

Table 7. *Q_i Values*

Years	Q_i
2021	0,163571
2020	0,181768
2019	0,164112
2018	0,154941
2017	0,16579
2016	0,169817

The results of the relative importance values are given in Table 7. The calculation results of the P_i values, which express the performance index and are the other stage of the method, are given in Table 8:

Table 8. *P_i Values*

Years	P_i
2021	89,98872
2020	100
2019	90,28648
2018	85,24118
2017	91,20956
2016	93,42512

As a result of the calculations performed using the COPRAS method, the best and worst alternatives are decided among the alternatives in terms of performance. As a result of the analysis performed for the ALKA plant, the performance ranking by years is available in Table 9:

Table 9. *Ranking of Financial Performance by Years*

Years	Ranking
2021	5
2020	1
2019	4
2018	6
2017	3
2016	2

According to Table 9, the year in which the ALKA enterprise performed best was determined as 2020. According to the results of the analysis, the second-best year was 2016 and the third-best year was 2017. It is that the year in which the business performed the worst was 2018. The performance ranking obtained by applying the COPRAS method to 9 enterprises is given in Table 10:

Table 10. *Financial Performance Ranking of Enterprises*

Years	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
2021	MNDTR	KAPLM	KARTN	BAKAB	ALKA	SAMAT	DURDO	PRZMA	VKING
2020	BAKAB	KARTN	ALKA	KAPLM	MNDTR	PRZMA	DURDO	SAMAT	VKING
2019	VKING	SAMAT	DURDO	KARTN	ALKA	BAKAB	KAPLM	MNDTR	PRZMA
2018	VKING	DURDO	KARTN	PRZMA	KAPLM	BAKAB	MNDTR	ALKA	SAMAT
2017	VKING	DURDO	PRZMA	KAPLM	ALKA	MNDTR	BAKAB	KARTN	SAMAT
2016	VKING	SAMAT	PRZMA	ALKA	MNDTR	BAKAB	KAPLM	KARTN	DURDO

The financial performance ranking obtained as a result of applying the COPRAS method to the data of 9 enterprises for the years 2016-2021 is available in Table 10. When Table 10 is examined, it is found that the VKING business performed the best between 2016-2019. In 2020 and 2021, it is observed that the performance of the VKING enterprise is in the 9th place. It is also obtained from the table that BAKAB enterprises in 2020 and MNDTR enterprises in 2021 show the best performance. The financial performance ranking of all enterprises according to the COPRAS method is reported in the table above.

In the study, the financial performances of the enterprises were tested by applying the COPRAS method and the MOORA method. The MOORA method was applied to the data of 9 enterprises between the years 2016-2021, as in the COPRAS method. In order to obtain integrity in terms of representation in the study, only the results of the ALKA enterprise are shown and the financial performances of all enterprises are included in the last table. The decision matrix created by applying the MOORA method to the ALKA enterprise is given in Table 11:

Table 11. *Decision Matrix*

Years	**Utility**							**Cost**
	FR1	**FR2**	**FR3**	**FR4**	**FR5**	**FR6**	**FR7**	**FR8**
2021	2,6	1,25	2,08	1,63	66,44	6,52	42,79	39,3
2020	3,63	1,51	2,82	1,5	45,07	6,24	31,47	28,39
2019	3,04	1,48	2,52	1,69	28,38	6,27	19,32	32,38
2018	3,03	1,03	1,99	1,78	33,9	5,45	23,87	31,42
2017	3,4	1,53	2,46	1,36	21,69	6,06	15,79	27,32
2016	3,58	1,78	2,93	1,04	21,45	5,86	15,63	27,12
Weight	0,13	0,13	0,13	0,13	0,05	0,13	0,05	0,25

The decision matrix of the ALKA enterprise is given in Table 11. Using the MOORA method, the squares of the financial ratios were taken, and the square root of the sum obtained by adding the squares was taken. The results are shown in Table 12:

Table 12. *Results of Square Root and Addition Operations*

Years	FR1	FR2	FR3	FR4	FR5	FR6	FR7	FR8
2021	6,76	1,5625	4,3264	2,6569	4414,274	42,5104	1830,984	1544,49
2020	13,1769	2,2801	7,9524	2,25	2031,305	38,9376	990,3609	805,9921
2019	9,2416	2,1904	6,3504	2,8561	805,4244	39,3129	373,2624	1048,464
2018	9,1809	1,0609	3,9601	3,1684	1149,21	29,7025	569,7769	987,2164
2017	11,56	2,3409	6,0516	1,8496	470,4561	36,7236	249,3241	746,3824
2016	12,8164	3,1684	8,5849	1,0816	460,1025	34,3396	244,2969	735,4944
	FR1	**FR2**	**FR3**	**FR4**	**FR5**	**FR6**	**FR7**	**FR8**
	7,920593	3,550099	6,101295	3,723251	96,59592	14,88377	65,25339	76,60313

The process of normalizing the decision matrix, which is the step of the MOORA method, is shown in Table 13. X_{ij} values were calculated in the normalization process:

Table 13. *Normalized Decision Matrix*

Years	FR1	FR2	FR3	FR4	FR5	FR6	FR7	FR8
2021	0,328258233	0,352102897	0,340911236	0,437789417	0,687813739	0,438061065	0,655751341	0,513033859
2020	0,458298995	0,4253403	0,462196964	0,402873696	0,46658286	0,419248627	0,482273772	0,370611483
2019	0,383809627	0,416889831	0,413027074	0,453904364	0,293801233	0,421264245	0,296076558	0,422698126
2018	0,382547095	0,290132788	0,326160269	0,478076786	0,350946505	0,366170676	0,365804733	0,410166001
2017	0,429260767	0,430973947	0,403193096	0,365272151	0,224543648	0,407154916	0,241979754	0,356643385
2016	0,451986337	0,501394526	0,480225924	0,279325763	0,222059071	0,39371746	0,239527774	0,354032526

After the normalization of the decision matrix, these values are multiplied by their weight ratios to form a weighted normalized decision matrix. Reporting results are given in Table 14:

Table 14. *Weighted Normalized Decision Matrix*

Years	FR1	FR2	FR3	FR4	FR5	FR6	FR7	FR8
2021	0,04267357	0,045773377	0,044318461	0,056912624	0,034390687	0,056947938	0,032787567	0,128258465
2020	0,059578869	0,055294239	0,060085605	0,052373581	0,023329143	0,054502321	0,024113689	0,092652871
2019	0,049895251	0,054195678	0,05369352	0,059007567	0,014690062	0,054764352	0,014803828	0,105674532
2018	0,049731122	0,037717262	0,042400835	0,062149982	0,017547325	0,047602188	0,018290237	0,1025415
2017	0,0558039	0,056026613	0,052415103	0,04748538	0,011227182	0,052930139	0,012098988	0,089160846
2016	0,058758224	0,065181288	0,06242937	0,036312349	0,011102954	0,05118327	0,011976389	0,088508131

The final stage of the MOORA method is to see the performance status by subtracting the sum of the benefit values from the cost values. The calculation results performed are shown in Table 15:

Table 15. *Subtraction of Cost Values from Benefit Values*

2021	0,185545759
2020	0,236624577
2019	0,195375726
2018	0,172897451
2017	0,198826458
2016	0,208435712

As a result of the application of the method, the financial performance ranking of the ALKA enterprise over the years has been realized. The ranking results performed are given in Table 16:

Table 16. *Ranking of Financial Performance by Years*

Years	**Ranking**
2021	5
2020	1
2019	4
2018	6
2017	3
2016	2

As a result of the application of the MOORA method, the financial performance ranking of the ALKA enterprise is shown in Table 12. As a result of the analysis, it was found that the year in which the enterprise performed best was 2020, and the year in which it performed the worst was 2018. The findings obtained as a result of the application of the MOORA method to 9 enterprises are given in Table 17:

Table 17. *Financial Performance Ranking*

Years	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
2021	MNDTR	KAPLM	KARTN	BAKAB	ALKA	DURDO	VKING	SAMAT	PRZMA
2020	BAKAB	KARTN	ALKA	SAMAT	VKING	KAPLM	DURDO	MNDTR	PRZMA
2019	DURDO	KARTN	ALKA	BAKAB	KAPLM	MNDTR	PRZMA	VKING	SAMAT
2018	KARTN	PRZMA	KAPLM	BAKAB	DURDO	ALKA	MNDTR	VKING	SAMAT
2017	PRZMA	DURDO	ALKA	KAPLM	MNDTR	VKING	BAKAB	KARTN	SAMAT
2016	PRZMA	ALKA	SAMAT	VKING	MNDTR	BAKAB	KAPLM	DURDO	KARTN

The data obtained as a result of applying the MOORA method to the data of 9 enterprises for the years 2016-2021 are available in Table 17. When the table is examined, it is observed that PRZMA company showed the best performance in 2016 and 2017, and the best-performing companies in 2019, 2020, and 2021 have changed. It is seen that the SAMAT enterprise has the worst performance between 2017-2020 and the performance of the PRZMA enterprise in 2020 and 2021 is poor. The table also includes the performance order of other enterprises. When both methods are evaluated together, it is concluded that parallel results are obtained, but there are also changes in the rankings.

Conclusion and Evaluation

Businesses; are organizations with functions such as management, marketing, finance, production, public relations, accounting, and purposes such as making profit, growth, development, meeting the need for goods and services. For businesses to achieve their goals, all functions must work in synergy and have an

open system. The financial objectives of the businesses are to maximize the market value and the wealth of the partners. Businesses can reach their financial goals by analyzing the information obtained from data sources such as balance sheets and income statements with various methods and making future-oriented decisions. Thanks to the information obtained from the data sources of the enterprises, decisions can be made on issues such as financial failure, financial performance, efficiency and productivity, and the current situation is determined. The concept of financial performance, which is the subject of the study, is a measurement method that is an indicator for businesses and gives information about the financial situation of businesses. Financial performance measurement can be performed with Multi-Criteria Decision Making (MCDM) methods, as is frequently mentioned in the literature. With this measurement, the years of the enterprises, their status with other enterprises and their position in the sector can be compared.

When the situation of the paper and paper products industry is analyzed, it is that Turkey's exports of paper and paper products in 2021 are $2.2 billion and the import volume is $4.08 billion. Import countries are Germany, Finland and Sweden. It is among the forecasts that the demand for pulp, paper, timber and textile will increase with urbanization and population growth. Considering the paper recovery rates, it is stated that the rate is around 70-75% in Europe and 40-45% in Turkey. It is observed that paper and paper products are also affected by the Covid-19 pandemic, like every sector, and the differentiation trend among sub-sectors is accelerating. It is foreseen that the demand for the sector will increase with the emerging needs.

As a result of the study, financial performance rankings were obtained by analyzing with COPRAS and MOORA methods. When the findings are examined, it is that the results of the analysis performed with the COPRAS and MOORA methods show parallelism, but there are also changes in the ranking of the enterprises. As a result of the COPRAS method with a general evaluation, it is

observed that the VKING business has been successful for 4 consecutive years. Again, according to the same method, it was concluded that the VKING business performed poorly in the last two years. According to the MOORA method, the PRZMA enterprise showed the best performance for two consecutive years, and the KARTN, DURDO, BAKAB and MNDTR enterprises were among the best-performing enterprises in different years. According to the MOORA method, the worst-performing enterprises in different years were determined as KARTN, SAMAT and PRZMA.

BAKAB and MNDTR enterprises were determined as the best-performing enterprises in the same year in both methods. According to the COPRAS and MOORA methods, it was concluded that the worst-performing joint venture in the same years was SAMAT. According to both methods, the existence of businesses in the same years and ranking is another determination. It is important to determine that similar results are obtained in the case of differences in methods, but the ranking of some enterprises has changed. The contribution of the study to the literature is expressed as the financial performance ranking with current data and two different methods, and we recommend that valuable researchers perform analysis by applying different methods and comparing the results of the study.

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