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Evaluation of financial performance of paper companies traded at BIST with TOPSIS method

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Abstract

Aim of study: It was aimed to rank financial performance of companies in the paper industry traded at BIST.

Material and methods: The financial performances of seven companies in the paper industry which are traded on the Borsa İstanbul (BIST) were determined by using financial data in 2016. For this purpose, ten financial ratios were obtained from the financial data of companies, each of which had its own superiority. The data were conducted by the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method which is the "Multi Criteria Decision Making" (MCDM) method to interpret.

Main results: The results indicated that the companies were ranked follows; ALKA, KARTN, VKING, BAKAB, TIRE, OLMIP and KAPLM based on the financial performance scores.

Research highlights: In Turkey, production in paper industry meets nearly half of the consumption and paper demand are met by imports. The high prices of energy and initial investment costs encourage imports of paper products and they prevent new investments. From this perspective, growth, development and high performance of paper companies will keep this industry alive.

Keywords: Performance Analysis, TOPSIS Method, Paper Industry

BİST'de işlem gören kağıt sektöründeki firmaların TOPSIS yöntemiyle finansal performanslarının değerlendirilmesi

Özet

Çalışmanın amacı: BİST'de işlem gören kağıt sektöründeki firmaların finansal performanslarına göre sıralanması amaçlanmıştır.

Materyal ve yöntem: Borsa İstanbul'da (BIST) işlem gören kağıt sektöründeki 7 firmanın 2016 yılına ait verileri kullanılarak finansal performansları belirlenmeye çalışılmıştır. Bu amaçla, şirketlere ait finansal verilerden 10 finansal oran elde edilmiştir ve bu finansal oranların her biri diğerlerine göre üstünlüğe sahiptir. Bütünleşik bir değerlendirme yapılması amacıyla, veriler "Çok Kriterli Karar Verme" (ÇKKV) yöntemlerinden olan TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) yöntemi ile değerlendirilmiştir.

Sonuçlar: Şirketler finansal performanslarına göre ALKA, KARTN, VKING, BAKAB, TIRE, OLMIP ve KAPLM olarak sıralanmıştır..

Araştırma vurguları: Ülkemiz kağıt sektöründe gerçekleştirilen üretim ile tüketimin yarısı karşılanabilmekte ve kağıt ihtiyacı ithalatla karşılanmaktadır. Enerji fiyatlarının ve ilk yatırım maliyetlerinin yüksek olması yeni yatırımları engellerken ithalata teşvik etmektedir. Bu bakımdan sektörde var olan firmaların gelişmesi, büyümesi ve performanslarının yüksek olması sektörü canlı tutacaktır.

Anahtar Kelimeler: Performans Analizi, TOPSIS metodu, Kağıt Sektörü

Introduction

Nowadays, national and international competition among companies has become more and more important. Therefore, the companies need to follow their financial situation and know their position among the other companies of the industry in order to keep their own companies alive. Financial performance measurement based on accounting data allows companies to analyse

their financial situation. Financial analysis helps to make decisions about the future of companies and provide important information to crediting organisations regarding financial support decisions. The comparison among the firms operating in the same industry allows evaluating strengths and weaknesses of companies.

Paper production in modern sense started in 1936 in Izmit/Turkey. In 1954, a corrugated cardboard manufacturing plant was established in our country. In 1955, this facility was converted to the General Directorate of the Turkish Pulp and Paper Plants Operation (SEKA) under the Ministry of Industry. After the 1960s, private industry investments also have started in paper industry growing and developing with public investments. However, the paper industry is still in the growth phase in our country and has not reached the world average regarding production and consumption (Yorulmaz, 2014, Çabuk et al. 2014).

Foreign trade data of the paper and paper products industry were obtained from TUIK (Turkish Statistical Institute) according to ISIC Rev.3 (digit-2) classification are given in Table 1. The report indicated that the amount of imported paper costs approximately $ 3.5 billion per year, and export-import coverage rate gradually increased year by year. Turkey where imports are more than exports in the paper-cardboard industry is suitable for new investments in the paper industry.

Table 1. Foreign Trade of the Paper Industry (Million $)

	2011	2012	2013	2014	2015	2016
Import	3.635	3.458	3.754	3.874	3.432	3.462
Export	1.407	1.647	1.934	1.985	1.779	1.891
Export-Import Coverage Rate%	38,72	46,63	51,51	51,23	51,82	54,61

TOPSIS method is a technique used by the most of the researchers in performance evaluation studies.

Feng, C. M. and Wang, R. T. (2000) used a TOPSIS method in a study using various financial ratios and conducted a financial performance evaluation of Taiwan's five major airlines.

In a study by Çakır, S., and Perçin, S., 2013, TOPSIS and VIKOR methods were used in order to rank the performance of logistics firms, and an integrated ranking was obtained by Borda Count method.

Ergül, N. (2014) used ELECTRE and TOPSIS methods in his analysis of the financial performances of the companies in BIST-Tourism industry.

In a study by Bakircı F. et al. (2014), DEA super efficiency and TOPSİS methods to analize the financial performances of the companies operating in Iron, Steel and Metal Industry in the BIST.

Multi Criteria Decision Making methods such as Electre, TOPSIS, VIKOR which are the very popular to make strategic and critical decisions in companies is also used to measure the financial performance of companies in various industries (Türkmen and Çağıl, 2012).

21 different criteria were analysed by fuzzy TOPSIS method in a study to evaluate the financial performance of Taiwan container shipping companies (Wang, 2014).

Meydan, C. et al. (2016) evaluated the financial performances of companies using a gray relational analysis method (GRA) in a study on food companies.

In a study entitled "Performance Evaluation of Sub-manufacturing Industry Using TOPSIS and ELECTRE Methods" by Ömürbek and Mercan (2014), financial performance measurement in the manufacturing industry consisting of 22 sub-industry was analysed by using nine different financial ratios published by the Central Bank of The Republic of Turkey.

The purpose of this study is to rank according to their performances via the TOPSIS method from the multi criteria decision-making techniques by using the financial ratios of Turkish paper companies. The performance analysis of the paper

industry will contribute to filling the gap in the literature.

Material and Method

Data of seven firms operating in the paper manufacturing industry which are traded at BIST, were obtained from KAP (Public Disclosure Platform) website. The companies included in the analysis were given in Table 2.

Table 2. Alternative Firms in the Paper Industry

Company Code	Company Name
ALKA	Alkim Paper Industry and Trade Co.
BAKAB	Bak Packaging Industry and Trade Co.
KAPLM	Kaplamin Packaging Industry and Trade Co.
KARTN	Kartonsan Cardboard Industry and Trade Co.
OLMIP	Olmuksan International Paper Packaging Industry and Trade Co.
TIRE	Mondi Tire Kutsan Paper and Packaging Industry Co.
VKING	Viking Pulp and Paper Mill Co.

In this study, four group of ratios were selected as the liquidity, financial structure, activity and profitability. In these groups, there were ten financial ratios in each group of ratio. The financial ratios in each ratio group and their codes were shown in Table 3.

Table 3. Ratios Used In Financial Analysis

Group of Ratio	Financial Ratios	Ratio Code
Liquidity	Current Ratio (Current Assets / Current Liabilities)	L1
Financial structure	Financial Leverage Ratio (Total Liabilities / Total Assets)	M1
	Equity Capital / Total Assets	M2
	Equity Capital / Total Liabilities	M3
	Current Assets / Total Liabilities	M4
	Fixed Assets / Equity Capital	M5
Activity	Net Sales / Total Assets	F1
	Net Sales / Equity Capital	F2
Profitability	Profitability of Equity (Net Profit / Equity Capital)	K1
	Profitability of Active Assets (Net Profit / Total Assets)	K2

In this study, TOPSIS method which is a multi-criteria decision-making technique developed by firstly Hwang and Yoon (1981) was used. According to this method, the alternatives are determined by their distance from the most appropriate solution. It is aimed to choose the optimal alternative which has the shortest distance from the ideal solution and the farthest distance from the negative ideal solution (Young, Ting and Hwang, 1994). The positive ideal solution maximises the total benefit related to the problem, while at the same time it minimises the total cost. Conversely, the negative ideal solution is the solution that maximises the total cost while minimising the utility (Yousefi and Hadi-Vencheh, 2010; Wang and Lee, 2007).

The TOPSIS method consists of 6 stages (Dashti et al., 2010; Dumanoglu, 2010; Behzadian et al., 2012)

Stage 1. Creation of the initial matrix

When the initial matrix A is formed, the decision points which are ranked according to their superiority must be in the rows, and the evaluation factors must be in the columns.

$$A_{ij} = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix}$$

The alternative number is denoted by "m" and the criterion number is denoted by "n" in the initial matrix Aij.

Stage 2. Forming and weighting of the normalize decision matrix

The normalised decision matrix (R_{ij}; i=1,…,m; j=1,…,n) is calculated using equation (1) with the elements of the matrix Aij.

$$r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^{m} a_{ij}^2}} \quad (1)$$

$$i = 1,2,3,\ldots,m \qquad j = 1,2,3,\ldots,n$$

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

The weight of the measure "j" is represented by W_{ij} in equation (2). The weighted normalized decision matrix (Vij; i=1, . . . ,m; j=1, . . . ,n) is calculated using equation (2) with the elements of the normalized matrix.

$$V_{ij} = W_{ij} * r_{ij} \quad (2)$$

$$i = 1,2,3,\ldots,m \qquad j = 1,2,3,\ldots,n$$

Stage 3. Determination of positive and negative ideal solutions

Positive-ideal solution (A^+) and negative ideal solution (A^-) values are determined from the values of the weighted normalised matrix (Vij). A^+ is the best performance score selected from the weighted normalised matrix, while A^- is the worst performance score selected from weighted normalised matrix.

Stage 4. Calculation of separation measures

Distance from positive-ideal solution (S_i^+) and the negative-ideal solution (S_i^-) of each alternative criterion is determined using equation (3) and (4).

$$S_i^+ = \sqrt{\sum_{j=1}^{n} (V_{ij} - V_j^+)^2} \quad (3)$$

$$S_i^- = \sqrt{\sum_{j=1}^{n} (V_{ij} - V_j^-)^2} \quad (4)$$

$$i = 1,2,3,\ldots,m \qquad j = 1,2,3,\ldots,n$$

Stage 5. Relative proximity calculation for positive (ideal) solution

Positive-ideal (S_i^+) and negative ideal (S_i^-) separation measures are used in the calculation of relative proximity to the ideal solution (C_i^+) for each decision point. The C_i^+ represents the relative proximity to the ideal solution and takes a value in the range $0 \leq Ci + \leq 1$. "$C_i^+=1$" shows the relative proximity to positive ideal solution, whereas "$C_i^+=0$" shows the relative proximity to negative ideal solution.

The relative proximity to the ideal solution (C_i^+; i=1, . . . ,m; j=1, . . . ,n) is calculated using equation (5).

$$C_i^+ = \frac{S_i^-}{S_i^- + S_i^+} \quad (5)$$

$$i = 1,2,3,\ldots,m$$

Stage 6. Sorting of alternatives by relative superiority

The obtained relative superiority scores represent the companies' performance achievement within industry. A higher score corresponds to a better performance. Scores can be used to determine the companies' ranking within its industry (Yurdakul and İç, 2005).

Results

Data of ten evaluating factors (financial ratios) which were obtained for the seven decision points (alternative company) were used in determining the financial performance of companies. The financial ratios belong to 2016 were converted to a single score indicating general operating performance through the TOPSIS method.

In the first stage, the standard decision matrix (7x10) formed by alternative firms and financial ratios is given in Table 4.

Table 4. Standard Decision Matrix

Companies	Criterias									
	L1	M1	M2	M3	M4	M5	F1	F2	K1	K2
ALKA	3,575	0,271	0,729	2,688	0,830	0,268	1,042	1,430	0,215	0,157
BAKAB	1,385	0,630	0,370	0,588	0,635	1,205	0,943	2,549	0,090	0,033
KAPLM	0,788	0,812	0,188	0,232	0,956	2,064	1,464	7,769	-0,048	-0,009
KARTN	2,360	0,192	0,808	4,207	0,848	0,787	0,912	1,129	0,010	0,008
OLMIP	0,910	0,665	0,335	0,504	0,915	1,282	1,032	3,080	0,012	0,004
TIRE	1,601	0,463	0,537	1,158	0,907	0,609	1,320	2,459	-0,056	-0,030
VKING	0,523	0,998	0,002	0,002	0,591	384,179	0,899	500,001	-48,855	-0,088

In the second step, the normalised decision matrix (R) was calculated using equation 1 and were weighted.

$$r_{11} = \frac{3,575}{\sqrt{3,575^2+1,385^2+\cdots+0,523^2}} = 0,721$$

The calculated R-value was shown in Table 5.

Table 5. Normalized Decision Matrix

Companies	Criterias									
	L1	M1	M2	M3	M4	M5	F1	F2	K1	K2
ALKA	0,721	0,162	0,550	0,518	0,381	0,001	0,356	0,003	0,004	0,844
BAKAB	0,280	0,375	0,279	0,113	0,292	0,003	0,322	0,005	0,002	0,180
KAPLM	0,159	0,483	0,142	0,045	0,439	0,005	0,500	0,016	-0,001	-0,049
KARTN	0,476	0,114	0,610	0,811	0,390	0,002	0,312	0,002	0,000	0,045
OLMIP	0,184	0,396	0,253	0,097	0,421	0,003	0,353	0,006	0,000	0,021
TIRE	0,323	0,276	0,405	0,223	0,417	0,002	0,451	0,005	-0,001	-0,163
VKING	0,106	0,595	0,001	0,000	0,272	1,000	0,307	1,000	-1,000	-0,473

W_{ij} for all values was 0.10 and the normalised decision matrix was weighted using equation 2.

The obtained values were given in Table 6.

Table 6. Weighted Normalized Decision Matrix

Companies	Criterias									
	L1	M1	M2	M3	M4	M5	F1	F2	K1	K2
ALKA	0,0721	0,0162	0,0550	0,0518	0,0381	0,0001	0,0356	0,0003	0,0004	0,0844
BAKAB	0,0280	0,0375	0,0279	0,0113	0,0292	0,0003	0,0322	0,0005	0,0002	0,0180
KAPLM	0,0159	0,0483	0,0142	0,0045	0,0439	0,0005	0,0500	0,0016	-0,0001	-0,0049
KARTN	0,0476	0,0114	0,0610	0,0811	0,0390	0,0002	0,0312	0,0002	0,0000	0,0045
OLMIP	0,0184	0,0396	0,0253	0,0097	0,0421	0,0003	0,0353	0,0006	0,0000	0,0021
TIRE	0,0323	0,0276	0,0405	0,0223	0,0417	0,0002	0,0451	0,0005	-0,0001	-0,0163
VKING	0,0106	0,0595	0,0001	0,0000	0,0272	0,1000	0,0307	0,1000	-0,1000	-0,0473

In the third stage, the largest value in each column of the weighted normalised decision matrix is selected for the positive-ideal solution (A^+) value, and the smallest value in each column of the weighted normalised decision matrix is selected for the negative-ideal solution value. The determined positive and negative ideal solution values are given in Table 7.

Table 7. Positive and Negative Ideal Solution Values

Companies	Criterias									
	L1	**M1**	**M2**	**M3**	**M4**	**M5**	**F1**	**F2**	**K1**	**K2**
$\mathbf{A^+}$	0,0721	0,0595	0,0610	0,0811	0,0439	0,1000	0,0500	0,1000	0,0004	0,0844
$\mathbf{A^-}$	0,0106	0,0114	0,0001	0,0000	0,0272	0,0001	0,0307	0,0002	-0,1000	-0,0473

In the fourth stage, the distance from the positive-ideal solution (S_i^+) and from the negative-ideal solution (S_i^-) of each alternative were calculated using Equations (3) and (4).

S_i^+= (0,1515; 0,1822; 0,1972; 0,1720; 0,1910; 0,1911; 0,2053)

S_i^-= (0,1926; 0,1272; 0,1185, 0,1564; 0,1195; 0,1192; 0,1491)

In the fifth stage, the equation five was used to calculate the relative proximity to the positive (ideal) solution, and the proximity value to ideal solution (C_i^+) of each firm was determined.

$$C_1^+ = \frac{0,1926}{0,1926 + 0,1515} = 0,5598$$

were calculated as.

In the sixth stage, the companies were ranked according to their proximity to the positive-ideal solution. The table 8 shows ranking of the companies based on the and C_i^+ values obtained from financial performance analysis results.

Table 8. C_i^+ Values And Rankings of Paper Companies

Ranking	Companies	C_i^+
1	**ALKA**	0,5598
2	**KARTN**	0,4763
3	**VKING**	0,4208
4	**BAKAB**	0,4113
5	**TIRE**	0,3849
6	**OLMIP**	0,3842
7	**KAPLM**	0,3754

Performance analysis was conducted using certain financial ratios derived from financial data published by the BIST for paper companies in 2016. The company with the best financial performance was the company with the code ALKA whereas the KAPLM had the lowest C_i^+ values (Table 8).

Conclusion

In this study, the financial performances of seven BIST-listed paper companies were analysed with 2016 financial data by TOPSIS method. was utilised for the analysis.

As a result of the financial analysis, Companies listed as ALKA, KARTN, VKING, BAKAB, TIRE, OLMIP and KAPLM were ranked from being strong to weak based on the financial performance scores.

This study can be extended by using different financial ratios and methods to analyse the financial performance of any companies in the same industry. The results of this study using the TOPSIS method, which provides an objective evaluation opportunity by evaluating several criteria at the same time will provide decision-making convenience to industry players and investors.

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