

**Swami Vivekananda Advanced Journal for Research and Studies**Online Copy of Document Available on: www.svajrs.com

ISSN:2584-105X

Pg. 137-143



Measuring liquidity and efficiency of selected large cap Indian cement companies with the help of TOPSIS technique – an Empirical Study

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Abstract

India has registered 8% share of the global installed capacity in respect of cement production and emerged as the second largest cement producing country in the world. Abundances of limestone and coal, eco-friendly technology and growing demand, Indian cement industry is the major place of attraction of investors in the world. In this paper it has attempted to analyse the financial performance of 12 selected large cement companies in India. All of these companies have been selected by convenient sample method from the list of large cement companies given by Cement Information System (CIS), Department for Promotion of Industry and Internal Trade, Government of India. All data are secondary and collected from Capital Line Corporate Database for the period of 2014 to 2023. 5 ratios in each category of liquidity and efficiency i.e. total in 10 ratios have been used as criterion to form a matrix for analytical purpose. TOPSIS (Technique for order preference by similarity to ideal solution) with entropy weighted method have used to determine the rank of the companies in respect of liquidity, efficiency and ranked the overall performance. Spearman's rank correlation coefficient indicates that there is significant correlation between the liquidity, efficiency and overall performance.

Keywords: TOPSIS, Entropy, liquidity ratio, efficiency ratio.

Introduction

India is the 2nd largest cement producing country in the world and has a huge potentiality of growth in future. As a result, cement industry in India has been able to attract the attention of investors for many years. Before making investment decision it is desirable to measure the financial health of a company in term of liquidity, profitability, efficiency and measure the overall financial performance in respect of all of these. The financial performance of Indian cement companies has been measured in different angles. Panigrahi, A. K. (2013) examined the liquidity position of 5 leading listed companies; Geetha. N. et al. (2014) evaluated the overall efficiency of selected cement companies by using different financial ratios with DEA analysis. Dhivya et al. (2017) measured the financial performance of cement companies in respect of liquidity and profitability using trend analysis; Kaur et al. (2013) analysed the working capital management of cement companies in terms of profitability and liquidity; Pratap et al. (2021) measured the short-term financial performance by using liquidity and profitability ratios; Sasikala R et al. (2015) evaluated the Problems and Prospects of Selected Cement Companies in India by using liquidity and profitability ratios. Kumar, R. (2016) evaluated the financial performance of 10 listed Indian cement companies under TOPSIS method with average weight. Ratio analysis is an important tool to measure the financial performance of a company. But difficulties arise when we consider too many ratios (criteria) to measure the financial performance among the large number of companies and ranked according to their performance. In that case Multi-Criteria-Decision-Making (MCDM) model play a very vital role to determine rank precisely of the companies as per their performance. TOPSIS, VIKOR, DEMATEL are some important methods in this respect. There are very few mentionable works to analyse the financial performance of cement companies in India under MCDM method. In order to bridge this gap in this paper it has been attempted to analysed the financial performance of 12 selected cement companies of India using TOPSIS method.

Objective:

The main objective of our study is to analyze the liquidity and efficiency of the selected cement companies. For this purpose, the sub-objectives are

- 1) To evaluate the liquidity position of selected cement companies under study.
- 2) To identify the efficiency position of the cement companies under the study.
- 3) To determine the rank of the selected companies under the study with the help of TOPSIS technique.

Survey of existing literature:

(Türegün, 2022) measured the financial performance of 10 tourism companies at Borsa Istanbul, Turkey for the period of 2018 to 2020 by applying multi-criteria decision- making technique such as TOPSIS and VIKOR. Entropy method was adopted to determine weight of different criterion used in TOPSIS and VIKOR. All the data were secondary data and were collected form public disclosure platform of Borsa Istanbul Stock Exchange (BIST). 20 ratios in 6 categories such as liquidity, activity, financial structure, profitability, market and growth were considered to measure the performance. It was observed both TOPSIS and VIKOR method almost same rank.

(Hemalatha & Kmalavalli, 2018) evaluated the profitability of 15 cement companies in India during the period from 2005 to 2015. All the secondary data were collected form Capitaline Plus database. Different ratios and statistical tools such as mean, coefficient of variation, correlation and multiple regression were used for analytical purpose. Correlation analysis revealed that, there exists positive relationship between gross profit ratio, net profit ratio, operating profit ratio and also with the return on equity. (Venkatacham & Kasthuri, 2016) attempted to evaluate the financial performance of Cement Industry in India with a view to financial performance and investigate the factors effecting on profitability during the period of 2006 to 2016 by using secondary data. Different financial and statistical tool like ANOVA were used to analyse the data. It was concluded all the ratios such as current ratio, liquidity ratio, net profit ratio, Debt Equity Ratio, Interest Coverage Ratio had been used here have positive impact on profitability positions of the cement industry in India.

(Geetha & Ramasamy, 2014)evaluated the overall efficiency by analysing the data of 17 selected Indian cement companies for the period from 2001-2002 to 2012-2013 by using secondary data and were collected from Economic Survey of India, Central Statistical Organization etc. Compound Aggregate Growth rate (CAGR), different financial ratios and DEA analysis were used as tools for analysis the data. The result showed the improvement of performance efficiency of the Indian cement industry during the period of study.

(Panigrahi, 2013) attempted to examine the liquidity position of 5 leading listed Indian cement companies in order to examine the management of working capital and compare the liquidity position during the period of 2001 to 2010 by using secondary data collected form Annual reports of the companies and the website www.moneycontrol.com. Percentage method, mean, standard deviation, coefficient of variation, Ratio Analysis, Motaal's Ultimate Rank Test were used as tools and technique to analyse the data. It was concluded that, in all companies growth rate of current liabilities were higher than current assets.

(Kumar R. , 2016) evaluated the financial performance of 10 major cement companies in India selected from the list of NSE under the TOPSIS method for the period of 2011 to 2015. All secondary data were collected from website of the companies. 16 financial ratios used as criteria, average weight was assigned for each criterion for TOPSIS analysis, Spearman correlation was used for financial analysis. There found a low association between the rank determine by TOPSIS and the rank on the basis of capitalization.

(Fahami, Azhar, Rahim, & Rahim, 2019) evaluated the financial performance of 10 Malaysian Service sector companies in the year 2017. They measured the financial performance by using the method, Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) and used different financial ratios such as current ratio, acid test ratio, debt equity ratio, debt ratio, ROA, ROE and EPS to evaluate the financial performance of these companies. All the data were secondary data, collected from Bursa Malaysia website. Analysed data were presented by matrix and table. It was concluded that Bursa Malaysia website is the best company and ranked 1 and e Sime Darby Berhad was the worst company and ranked 10 out of 10 service companies.

(Erkhembaatar & Bataa, 2020) focused on Entropy Weight Method for Evaluating Indicators of ICT Development Index. They mentioned that entropy weight was developed by Claude E. Shannon in the middle of the 20th century mainly for interest of communication engineering purely based on statistics and probability theory. In this paper the considered ICT Development Index (IDI) which is the combination of 11 indicators to measure the development of different countries and determine weight of each indicator on the basis of certain formula. Here they attempted to determine the indicators of IDI by entropy method and concluded that entropy weight theory firmly focused on the relative position of each ICT indicator data set.

(Kharusi & Başci, 2017) investigated financial performance of 16 different financial institutions in Oman by using TOPSIS technique for the period of 2001 to 2015. 9 commercial banks, 3 specialized banks, 2 investment companies, and 2 finance companies were selected for this purpose. All the data were secondary data and collected from company's website, annual report etc. Deposits & short-term funding, Total assets, return on average assets (ROAA), Return on average equity (ROAE), Loan loss res / gross loans, Cost to income ratio and Number of employees were used as a variable for TOPSIS analysis. Spearman's Rho (Rank-Order) Correlation was used to assess the rank result correlation of different years. Spearman's Rho Correlation analysis showed strong relationships between two ranked variables.

Methodology of the study:

Sample design: Cement Information System (CIS), Department for Promotion of Industry and Internal Trade, Government of India, Ministry of Commerce and Industry provide the list of 93 large cement companies in India out of which 12 large companies have conveniently selected for this study. These companies are ACC Cement Ltd., Ambuja Cement Ltd., Andhra Cement Ltd., Anjani Portland Cement Ltd., Birla Corporation Ltd., Burnpur Cement Ltd., Cement Corporation of India Ltd. (CCI), Deccan Cement Ltd., Dalmia Cement (Bharat) and Vhavva Cement Pvt. Ltd., Star Cement Pvt. and Ultra Tech Cement Pvt. Ltd.

Collection of data: All the data used in this study are secondary data and collected for the period of 2014 to 2023 from Capital Line Corporate Database.

Data analysis: Different types of mathematical tools like average, percentage and various types of ratios, statistical tool such as Spearman's rank correlation and tables, TOPSIS technique with entropy weightage method have used for analytical purpose.

For the purpose of liquidity analysis of the companies under the study the following 5 ratios have taken in to account such as Cash Flow to Net Income Ratio (CFNIR), Current Liability Coverage Ratio (CLCR), Cash Interest Coverage Ratio (CICR), Current Ratio (CR) and Liquid Ratio (LR).

For analyzing the efficiency of the companies under the studies the following 5 ratios have considered such as Inventory Turnover Ratio (ITR), Debtors Turnover Ratio (DTR), Working Capital Turnover Ratio (WCTR), Fixed Asset Turnover Ratio (FATR) and Capital Employed Turnover Ratio (CETR)

TOPSIS (Technique for order preference by similarity to ideal solution) method:

The TOPSIS method which was developed by Hwang and Yoon (1981) compare a set of alternatives by identifying weight for each criterion. TOPSIS method helps to solve the multi-criteria decision-making problem by considering the geometric distance from both positive and negative ideal value. This method consists of following steps in order to reach the final solution: -

1)-Formation of decision matrix $(X_{ij})_{m \times n}$

Here, Decision matrix is consisting of 10 alternatives companies (m) and 15 criteria or financial ratios (n). The score of each alternative with respect to each criterion is given as X_{ij} and then the matrix is formed as below-

$$(X_{ij})_{m \times n} = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{22} & & X_{2n} \\ \vdots & \vdots & & \vdots \\ X_{m1} & X_{m2} & & X_{mn} \end{bmatrix}$$

1)- Normalize the decision matrix:

$$r_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^m X_{ij}^2}} \quad i = 1, 2, \dots, m; \quad j = 1, 2, \dots, n$$

$$R = (X_{ij})_{m \times n} = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & & r_{2n} \\ \vdots & \vdots & & \vdots \\ r_{m1} & r_{m2} & & r_{mn} \end{bmatrix}$$

2)- Calculation of weighted normalized matrix.

$$V_{ij} = W_j r_{ij} \quad i = 1, 2, \dots, m; \quad j = 1, 2, \dots, n$$

Where, W_j is the weight of the j th criteria or attribute, calculated by entropy method. **Entropy** is one of the objective methods to determine weight and this method was developed by Claude E. Shannon in the middle of the 20th century purely based on statistics and probability theory. The entropy method for determining the relative importance of criteria is calculated by using material data for each criterion, the entropy of the set of normalized outcomes of the j th criterion is given by

$$e_j = \frac{-1}{\ln(m)} \sum_{i=1}^m n_{ij} \ln(n_{ij})$$

Where, $i = 1, 2, 3, \dots, m$; and $j = 1, 2, 3, \dots, n$;

e_j is the information entropy value for j th criteria.

Where, n_{ij} is the normalized decision matrix and is given by,

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

Where, X_{ij} is the element of decision

The degree of diversity (d_j) possessed by each criterion is evaluated as

$$d_j = 1 - e_j, \quad j = 1, 2, 3, \dots, n;$$

The weight value (w_j) of each criterion is given by

$$w_j = \frac{d_j}{\sum_{i=1}^m d_j}$$

$$V_{ij} = \begin{bmatrix} w_1 r_{11} & w_2 r_{12} & \dots & w_n r_{1n} \\ w_1 r_{21} & w_2 r_{22} & & w_n r_{2n} \\ \vdots & \vdots & & \vdots \\ w_1 r_{m1} & w_2 r_{m2} & & w_n r_{mn} \end{bmatrix}$$

1) Determination of the positive or best ideal solution and negative or worse ideal solution.

Positive ideal solution (V_j^+) is the best performance of each matrix column or criteria of the weighted normalization Decision matrix and negative ideal solution (V_j^-) is the worst performance of each matrix column or criteria of the weighted normalization Decision matrix.

2) Calculation of the Euclidean distance form ideal best.

It determines the closest position to positive ideal solution. The distances to the positive ideal solution of each alternative are calculated by the Euclidean distance approach, using the values in the weighted normalization matrix and the values in the positive ideal solution clusters.

$$S_i^+ = \sqrt{\sum_{j=1}^n (V_{ij} - V_j^+)^2} \quad i = 1, 2, \dots, m; \quad j = 1, 2, \dots, n$$

3) Calculation of the Euclidean distance form ideal worse.

It is the farthest position to negative ideal solution. The distances to the negative ideal solution of each alternative are calculated by the Euclidean distance approach, using the values in the weighted normalization matrix and the values in the negative ideal solution clusters.

$$S_i^- = \sqrt{\sum_{j=1}^n (V_{ij} - V_j^-)^2} \quad i = 1, 2, \dots, m; \quad j = 1, 2, \dots, n$$

4) Calculation of performance score or the correspondence closeness coefficient of the i th alternatives.

$$C_i = \frac{S_i^-}{(S_i^+ + S_i^-)}; \quad 0 \leq C_i \leq 1$$

C_i = The closeness coefficient of each alternative

5) Rank of the Companies.

Ranking of alternatives is determined by comparing values of C_i . The highest relative closeness value is the

ideal alternative and considered as the best alternative in terms of the related multi-criteria decision-making problem and ranked 1.

Analysis And Interpretation:

Table No. 1 shows the Liquidity position of 12 selected cement companies during the period 2014-2023 under TOPSIS method. It is observed that Deccan Cement Ltd. has maintained good liquidity position during the period of study. Except in the year 2020 and 2023, all the years the rank of liquidity position varied between 1 to 5 which indicates Deccan Cement Ltd.'s liquidity position remained towards top five position during the period of study. The sum total of liquidity of Deccan Cement Ltd. during the period is 40. Therefore, on the basis of liquidity Deccan Cement Ltd. occupied 1st position. Similarly, ACC Cement Ltd. occupied 2nd position and Star Cement Ltd. occupied 3rd position. It is also observed that Ambuja Cement Ltd. has gradually improved its liquidity position and occupied 4th position during the period of study. Andhra Cement Ltd. ranked invariably poor in term of liquidity during the period and occupied 12 positions out of 12 selected cement companies.

Table 1.0

Liquidity Position of the 12 selected cement companies during the period of 2014-23 under TOPSIS Method:

	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	TOTAL	RANK
ACC	4	2	2	3	7	5	7	7	3	3	43	2
Ambuja	3	4	3	7	6	6	8	8	7	1	53	4
Andhra	1	11	12	12	11	11	10	12	12	12	104	12
Anjani	12	10	1	1	8	4	9	10	9	10	74	9
Birla	11	9	10	9	9	9	4	6	8	8	83	10
Burnpur	8	12	11	11	12	12	11	5	2	5	89	11
CCI	9	1	7	8	10	10	5	2	4	7	63	6
Deccan	6	3	4	6	5	2	2	3	5	4	40	1
Dalmia	7	8	6	2	2	8	12	4	6	11	66	8
Vhavya	10	7	9	5	4	7	1	1	1	9	54	5
Star	2	5	5	4	1	1	3	9	11	6	47	3
UltraTech	5	6	8	10	3	3	6	11	10	2	64	7

Table No.2.0.

Efficiency position of the 12 selected cement companies during the of 2014 - 23 under TOPSIS method

Table No. 2 shows the efficiency position of the 12 selected cement companies during the period of 2014-2023 under TOPSIS method. It is observed that the positional value of efficiency of ACC Cement Ltd., varied between 1 to 5, which indicates that the ACC

Cement Ltd. has maintained very consistent level of efficiency during the period under study. The sum total of positional value of efficiency in different years is 36 which is lowest out of 12 selected cement companies. So, ACC Co. Ltd. holds 1st position in terms of efficiency during the period of study. The sum total of positional value of efficiency of

Star Cement Ltd. is 42 and holds 2nd position. The sum total of positional value of efficiency of Birla Corporation Ltd. is 52 and holds 3rd position. It also observed except in the years of 2015,2018and 2021the performance of Ultra Tech Cement Ltd. is remarkably good and occupied 4th position in term of efficiency. Again, positional value of efficiency of Andhra Cement Ltd. varied between 7 to 12, which indicates this company's efficiency position remained towards the last consistently during the period of study and occupied 12thposition out of 12 selected cement companies during the period of study

	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	TOTAL	RANK
ACC	7	4	4	5	4	3	2	1	2	4	36	1
Ambuja	12	7	9	11	12	10	7	4	4	2	78	10
Andhra	9	1	10	12	10	9	12	7	11	12	93	12
Anjani	8	6	7	7	7	6	3	2	8	8	62	5
Birla	5	3	3	6	9	7	5	6	5	3	52	3
Burnpur	1	10	11	3	3	11	11	12	7	6	75	9
CCI	11	8	8	8	8	1	9	8	1	5	67	7
Deccan	10	9	6	9	6	4	4	3	6	9	66	6
Dalmia	2	11	1	10	11	8	10	10	10	11	84	11
Vhavya	6	12	2	4	5	5	8	11	9	10	72	8
Star	4	2	5	2	2	2	6	9	3	7	42	2
UltraTech	3	5	12	1	1	12	1	5	12	1	53	4

Table No.3

Rank Correlation between		Correlation coefficient
Liquidity	Efficiency	0.44055944
Liquidity	Liquidity and Efficiency as a whole	0.78321678
Efficiency	Liquidity and Efficiency as a whole	0.84615385

Liquidity & Efficiency position of the 12 selected cement companies as a whole during the of 2014 – 2023 on the basis of TOPSIS Rank

Table No. 3 represents the overall performance position of selected cement companies during the year of 2014 to 2023 in respect of liquidity, and efficiency

position of the companies. It is observed that total rank which is sum of rank occupied in liquidity, and efficiency of ACC Cement Ltd. is 3 which is lowest that indicates ACC Cement Ltd. occupied 1st position followed by Star Cement Ltd. occupied 2nd position, Deccan Cement Ltd. occupied 3rd position and again Andhra Cement Ltd. occupied 10th position in respect of overall performance.

	Liquidity Position	Efficiency Position	Total	Rank
ACC	2	1	3	1
Ambuja	4	10	14	8
Andhra	12	12	24	12
Anjani	9	5	14	8
Birla	10	3	13	5
Burnpur	11	9	20	11
CCI	6	7	13	5
Deccan	1	6	7	3
Dalmia	8	11	19	10
Vhavya	5	8	13	5
Star	3	2	5	2
UltraTech	7	4	11	4

Table No. 4

Table No.4 shows the rank correlation among the different criteria. It reveals that there exists a positive correlation among the different criteria. All the results of Rank Correlation Coefficient between Liquidity, efficiency and overall performance is positive that means some degree of association are there but Rank Correlation Coefficient between Efficiency and Overall Performance is 0.846, Profitability and overall performance is 0.783 which indicates the existence high degree of correlation among them. However, correlation coefficient between liquidity and efficiency is 0.4405 which indicates moderate degree of correlation between them

Conclusion:

The result shows by the TOPSIS method that, the ACC Cement Ltd. occupied the first position in respect of both liquidity and efficiency. Star Cement Ltd.

occupied the second position in respect of liquidity and efficiency. The rank of Deccan Cement Ltd. in respect of liquidity is 1 and in respect of efficiency is 6, so its overall rank is 3. Contrary, Andhra Cement Ltd. occupied very low rank in respect of liquidity, and efficiency as a result it occupied the last position in overall rank out of the 12 selected cement companies during the period of 2014 to 2023. Therefore, importance should be given to the liquidity management of Andhra Cement, Burnpur Cement, Dalmia Cement, Ambuja Cement, Anjani Cement etc. These companies are not at all efficient. Investors may choose ACC, Star and Decan Cement for growth of their funds.

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