

Operating Efficiency of Cement Industry in India Based on DEA Model

Dr. D. SILAMBARASAN

Assistant Professor

Department of Commerce

Saradha Gangadharan College

E-Mail: dsarasansss@gmail.com

Mobile: + (91) – 8695958104

Dr. K. SELVADURGADEVI

Assistant Professor

Department of Commerce

Saradha Gangadharan College

E-Mail: dr.selvadurgadevikandavel@gmail.com

Mobile: + (91) – 9597879996

Abstract

The study is an attempt to analyze the Operating Efficiency of Cement Industry in India using DEA Model, based on secondary data collected through money control. The study collected data over a 10 years period (2012 – 2021). The study selected 19 sample of cement industry in India which is listed in BSE. The study concluded that DEA approach shows that the overall mean of efficiencies of the firms are improved in VRS approach, CRS approach and Scale efficiency. Finally the study revealed that VRS approach show that Ambuja Cement, Everest Industry, J. K. Cement, Keerthi Industry, and NCL Industry have achieved 100% efficiency during the study period. CRS and scale efficiency show that Everest Industry only have achieved 100% in overall efficiencies.

Key words: Data Envelopment Analysis, Cost Efficiency, Revenue Efficiency, Profit Efficiency, Cement Industry

JEL: H21, D61

Introduction

Operating efficiency generally refers to the ability of an organization to deliver excellent services with fewer resources. The more output an organization can produce from a given amount of input, the more efficient those operations likely are. This is primarily a function of two variables, namely the quality of an entity's operations and its operating expenses. If an organization can maintain high levels of operating efficiency then it should be able to generate greater profit per project with the same resources¹.

The higher the efficiency of operations, the more profitable a company or investment is. Operational efficiency is the calculation of costs incurred during a specific economic or financial activity, meaning that the lower the costs and the higher the efficiency².

Review of Literature

Maudos and Pastor (2003) "cost, revenue, and profit efficiency in the Spanish banking sector" data collected period from 1985 to 1996 using DEA approach. The study revealed that 1996 indicate that "return on assets and return on equity" of the Spanish banking sector has increased by 2.4 and 24.4 for "ROA" and "ROE". **Almumani** (2013) the efficiency of Saudi banks using data envelopment analysis based on secondary data over the study period from 2007 - 2011. The study showed that mean efficiency has 95.52% and 98.55% respectively for CCR and BCR approaches.

Purwanto et al. (2014) "Efficiency of small and medium sized enterprises in Salatiga using data envelopment analysis" analyzed the cost efficiency of 66 Tofu SMEs. The results show that two SMEs were efficient in overall firms, four SMEs were efficient in scale efficiency, eight SMEs were technically efficient, and 23 SME were inefficient over the period.

Silambarasan and Azhagaiah (2018) used data envelopment analysis on 16 small size acquired manufacturing firms in India considering five years before merger (2004 to 2009) and after merger (2010 to 2014). The study founded that the paired sample t test of scale efficiency are statistically highly significant which means that there is a significant mean differences in the operating efficiency of the firms between the before and after merger periods.

Objectives of the Study

- To analyze the cost, revenue, and profit efficiencies of cement firms of india in respect of variable returns to scale.
- To analyze the cost, revenue, and profit efficiencies of cement firms of india in respect of constant returns to scale.

Hypotheses

H₀¹: There is no significant difference in cost, revenue and profit efficiencies of cement firms of India in respect of variable constant returns to scale.

H₀²: There is no significant difference in cost, revenue and profit efficiencies of cement firms of India in respect of constant returns to scale.

Methodology

The present study used secondary data collected from www.moneycontrol.com. The final sample includes 26 cement firms in India (full-fledged data for the study period i.e. from 2012 to 2021).

Table 2
The selected sample of cement firms in India

Sl. No.	Firm Name	Sl. No.	Firm Name
1	Ambuja Cement	11	Kakatiya Cement
2	Anjani Cement	12	KCP
3	Deccan Cement	13	Keerthi Industry
4	Everest Industry	14	Mangalam Cement
5	Guj Sidhee Cement	15	NCL Industry
6	HIL	16	Ramco Cement
7	India Cement	17	Ramco industry
8	J. K. Cement	18	Sahyadri Industry
9	Jaiprakash Association	19	Visaka Industries
10	JK Lakshmi Cement		

Source: Data collected from money control.

Variables Used for Analysis

The present study used input variables and output variable.

(a) Input Variables

X₁= Total Assets

X₂= Total shareholders' Equity

X₃= Total Net Worth

(b) Output Variables

Y₁= Total Income

Y₂= Loan and Advances

Analysis and Discussion

The table 2 shows descriptive statistics of input and output variables. The input variables ranges from 595.00 to 4.41; 70.00 to 4721.00; and 553.00 to 1.56 with mean of 5.29, 8.11, and 1.27 for inputs X_1 , X_2 and X_3 . The standard deviation records at 1.06, 1379.17, and 35024.00 for inputs X_1 , X_2 and X_3 . The output variables ranges from 81.00 to 1.10 and from 232.00 to 1.64 with mean of 2.32 and 2.34 and standard deviation of 30811.42 and 43540.57.

Table 2
Descriptive Statistics for Inputs and Outputs of Cement Industry in India

Input / output	Variables	Min	Max	Mean	S.D
Input Variables	X_1	595.00	4.41	5.29	1.06
	X_2	70.00	4721.00	8.11	1379.17
	X_3	553.00	1.56	1.27	35024.00
Output Variables	Y_1	81.00	1.10	2.32	30811.42
	Y_2	232.00	1.64	2.34	43540.57

Source: Data collected from money control.

VRS Approach

Table 3 show that for the VRS approach, the cost efficiency is perfectly relative for five overall DMUs (Ambuja Cement, Everest Industry, J. K. Cement, Keerthi Industry, and NCL Industry); revenue efficiency is perfectly relative for 10 overall DMUs (Ambuja Cement, Deccan Cement, Everest Industry, HIL, J. K. Cement, Kakatiya Cement, Keerthi Industry, NCL Industry, Ramco Cement, and Ramco industry); and profit efficiency is perfectly relative for 11 overall DMUs (DMUs stated for revenue efficiency and JK Lakshmi Cement) for VRS approach.

The cost, revenue and profit efficiencies of firms are 78%, 88% and 89% for VRS approach. Among the three efficiencies, the profit efficiency is high (89%); the revenue efficiency is found to be comparatively moderate (88%) than the profit efficiency; and cost efficiency is low (78%). The revenue and profit efficiencies are compared it is found that although the cost efficiency is low, the moderate revenue efficiency had contributed to the higher profit efficiency of all the firms in VRS approach.

Table 3
Cost, Revenue and Profit Efficiency of Cement Industry in India– VRS Approach

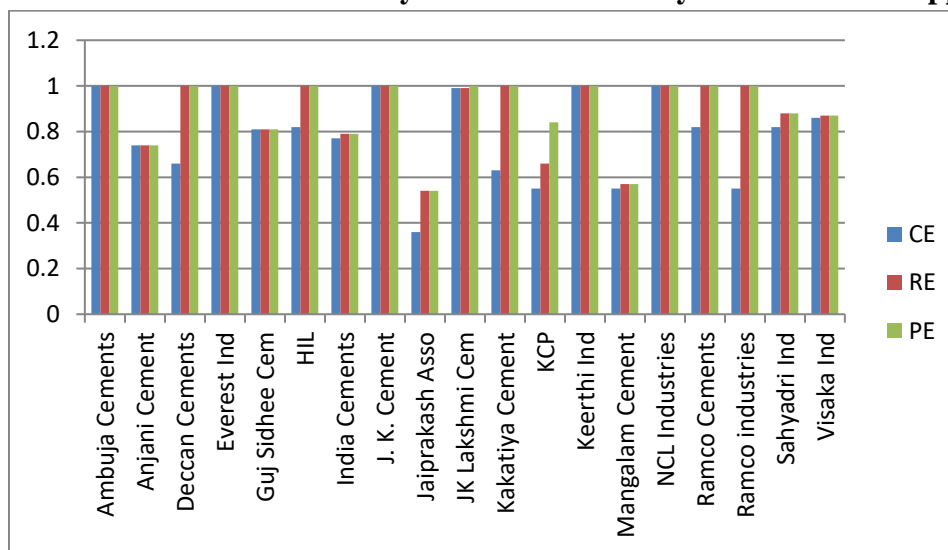
Sl. No.	Overall Decision Making Units (DMUs)	CE	RE	PE
1	Ambuja Cement	1	1	1
2	Anjani Cement	0.74	0.74	0.74
3	Deccan Cement	0.66	1	1
4	Everest Industry	1	1	1

5	Guj Sidhee Cement	0.81	0.81	0.81
6	HIL	0.82	1	1
7	India Cement	0.77	0.79	0.79
8	J. K. Cement	1	1	1
9	Jaiprakash Association	0.36	0.54	0.54
10	JK Lakshmi Cement	0.99	0.99	1
11	Kakatiya Cement	0.63	1	1
12	KCP	0.55	0.66	0.84
13	Keerthi Industry	1	1	1
14	Mangalam Cement	0.55	0.57	0.57
15	NCL Industry	1	1	1
16	Ramco Cement	0.82	1	1
17	Ramco industry	0.55	1	1
18	Sahyadri Industry	0.82	0.88	0.88
19	Visaka Industries	0.86	0.87	0.87
Overall DMUs		0.78	0.88	0.89

Source:

Data collected from money control.

Figure A
Cost, Revenue and Profit Efficiency of Cement Industry in India– VRS Approach



Source: Data collected from money control.

CRS Approach

Table 4 shows that for the CRS approach, the cost efficiency is perfectly relative for only one overall DMUs (Everest Industry); revenue efficiency is perfectly relative for four overall DMUs (Everest Industry, HIL, Ramco Cement, and Ramco Industry); and profit efficiency is perfectly relative for five overall DMUs (DMUs stated for revenue efficiency and Ambuja Cement) for CRS approach.

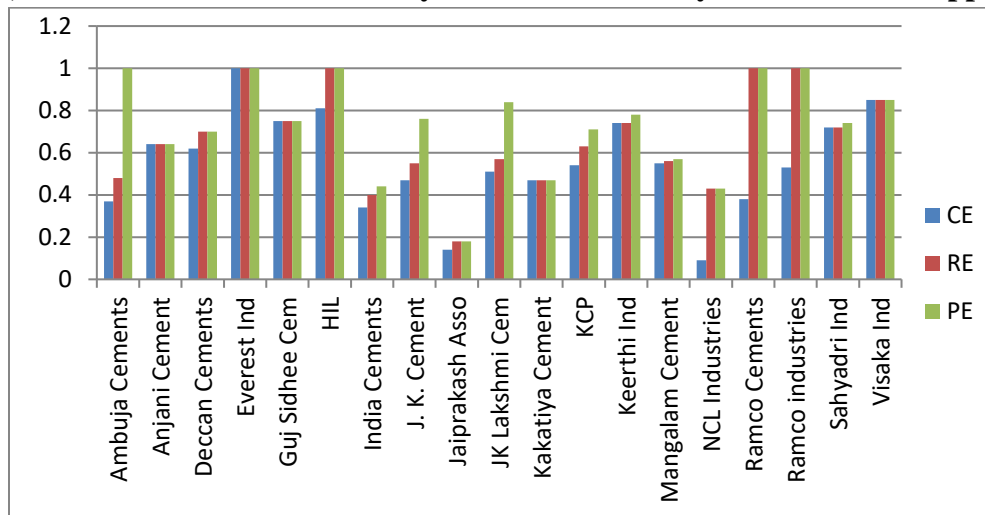
The cost, revenue and profit efficiencies of firms are 55%, 66% and 72% respectively for CRS approach. Among the three efficiencies, the profit efficiency is high (72%); the revenue efficiency is found to be comparatively moderate (66%) than the profit efficiency; and cost efficiency is low (55%). The revenue and profit efficiencies are compared it is found that although the cost efficiency is low, the moderate revenue efficiency had contributed to the higher profit efficiency of all the firms in CRS approach.

Table 4
Cost, Revenue and Profit Efficiency of Cement Industry in India– CRS Approach

Sl. No.	Overall Decision Making Units (DMUs)	CE	RE	PE
1	Ambuja Cement	0.37	0.48	1
2	Anjani Cement	0.64	0.64	0.64
3	Deccan Cement	0.62	0.7	0.7
4	Everest Industry	1	1	1
5	Guj Sidhee Cement	0.75	0.75	0.75
6	HIL	0.81	1	1
7	India Cement	0.34	0.4	0.44
8	J. K. Cement	0.47	0.55	0.76
9	Jaiprakash Association	0.14	0.18	0.18
10	JK Lakshmi Cement	0.51	0.57	0.84
11	Kakatiya Cement	0.47	0.47	0.47
12	KCP	0.54	0.63	0.71
13	Keerthi Industry	0.74	0.74	0.78
14	Mangalam Cement	0.55	0.56	0.57
15	NCL Industry	0.09	0.43	0.43
16	Ramco Cement	0.38	1	1
17	Ramco industry	0.53	1	1
18	Sahyadri Industry	0.72	0.72	0.74
19	Visaka Industries	0.85	0.85	0.85
Overall DMUs		0.55	0.66	0.72

Source: Data collected from money control.

Figure B
Cost, Revenue and Profit Efficiency of Cement Industry in India– CRS Approach



Source: Data collected from money control.

Scale Efficiency

Table 5 shows that the cost efficiency is perfectly relative for two overall DMUs (Everest Industry and Mangalam Cement); revenue efficiency is perfectly relative for four overall DMUs (Everest Industry, HIL, Ramco Cement, and Ramco Industry); and profit efficiency is perfectly relative for six overall DMUs (DMUs stated for revenue efficiency, Ambuja Cement and Mangalam Cement) for scale efficiency.

The cost, revenue and profit efficiencies of firms are 72%, 75% and 81% respectively for scale efficiency. Among the three efficiencies, the profit efficiency is high (81%); the revenue efficiency is found to be comparatively moderate (75%) than the profit efficiency; and cost efficiency is low (72%). The revenue and profit efficiencies are compared it is found that although the cost efficiency is low, the moderate revenue efficiency had contributed to the higher profit efficiency of all the firms in scale efficiency.

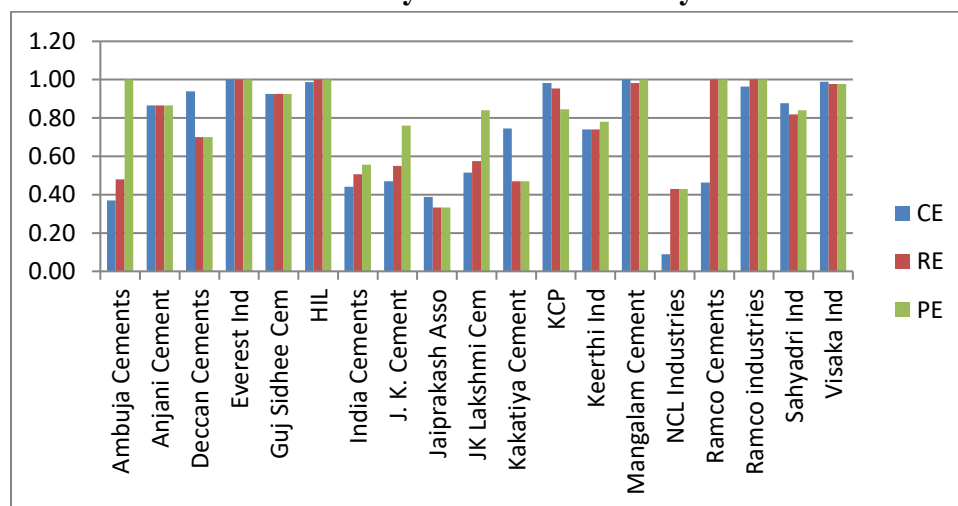
Table 5
Cost, Revenue and Profit Efficiency of Cement Industry in India – Scale Efficiency

Sl. No.	Overall Decision Making Units (DMUs)	CE	RE	PE
1	Ambuja Cement	0.37	0.48	1
2	Anjani Cement	0.86	0.86	0.86
3	Deccan Cement	0.94	0.70	0.70
4	Everest Industry	1	1	1
5	Guj Sidhee Cement	0.93	0.93	0.93

6	HIL	0.99	1	1
7	India Cement	0.44	0.51	0.56
8	J. K. Cement	0.47	0.55	0.76
9	Jaiprakash Association	0.39	0.33	0.33
10	JK Lakshmi Cement	0.52	0.58	0.84
11	Kakatiya Cement	0.75	0.47	0.47
12	KCP	0.98	0.95	0.85
13	Keerthi Industry	0.74	0.74	0.78
14	Mangalam Cement	1	0.98	1
15	NCL Industry	0.09	0.43	0.43
16	Ramco Cement	0.46	1	1
17	Ramco industry	0.96	1	1
18	Sahyadri Industry	0.88	0.82	0.84
19	Visaka Industries	0.99	0.98	0.98
Overall DMUs		0.72	0.75	0.81

Source: Data collected from money control.

Figure C
Cost, Revenue and Profit Efficiency of Cement Industry in India– Scale Efficiency



Source: Data collected from money control.

Conclusion

The study concluded that DEA approach shows that the overall mean of efficiencies of the firms are improved in VRS approach, CRS approach and Scale efficiency. VRS approach show that Ambuja Cement, Everest Industry, J. K. Cement, Keerthi Industry, and NCL Industry have achieved 100% efficiency during the study period. Hence, H_0^1 : There is no significant difference in cost, revenue and profit efficiencies of cement firms of India in respect of variable returns to scale. CRS approach show that the Everest Industry only have achieved 100% in overall efficiencies. Hence, H_0^2 : There is no significant difference in cost, revenue and profit efficiencies of cement firms of India in respect of constant returns to scale. However, the scale efficiency also showed Everest Industry only have achieved 100% in overall efficiencies.

Limitations

- The study considered 19 cement firms only.
- The study covers analysis of 10 years period from 2012 to 2021.

Scope for Further Studies

- Feature researcher may be undertaken in service sectors.

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