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A STUDY ON COST EFFICIENCY OF CEMENT INDUSTRIES IN TAMIL NADU USING AN APPLICATION OF DEA ANALYSIS

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ABSTRACT

Data Envelopment Analysis (DEA) measures efficiency of a Decision Making Unit (DMU) by maximizing the ratio of weighted outputs over weighted inputs. This ratio is normalized according to best practical peers and efficiency is calculated to be between 0 and 1, as 1 representing efficient unit. In this research the author make use of cement industry in Tamil Nadu to find out the cost efficiency. Ten years data has been employed in this study from 1996-97 to 2005-2006. To find out the cost efficiency the author employed DEA by an application of KonSI DEA Analysis for Benchmarking Software Professional Version. The author concludes that the selected cement companies should manage their cost efficiently from 2001-2002 to 2005-2006 for the sustainability and growth.

INTRODUCTION

Data Envelopment Analysis (DEA) is a non-parametric performance measurement tool that can be used for analysis and decision making in branch banking. The most common strengths of DEA include that it benchmarks branches, it provides potential improvement capabilities, it indicates sources of inefficiency and it takes management preferences into account when measuring performances. There are basically two types of DEA models: Charnes *et al*., (1978), introduced the constant returnsto- scale (CRS) and Banker *et al* .,(1984), introduced the variable returns-to-scale (VRS) model. DEA models are also classified as input-oriented, output-*oriented or additive* (both inputs and outputs are optimized in the best interest of the evaluated unit) based on the direction of the projection of the inefficient unit onto the frontier surface. Banker *et al* .,(1984). (BCC) relaxed CRS assumption and introduced VRS frontier. After these two basic models, many variations, options, contributions, Slack Based Models, Free Disposal Hull, Stochastic DEA, Network DEA, Dynamic DEA, Super Efficiency Models etc, have also been developed. In this research the author make use of an application DEA in cement industry to find out the cost efficiency.

Review of previous studies

Manandhar and Tang (2002), incorporated intangible aspects, e.g. the internal service quality, into DEA. They considered internal service quality, operating efficiency and profitability as dimensions of performance.

Manandhar and Tang (2002), analyzed the three dimensions of branch performance: Usage of new transaction channels, efficiency in increasing sales and customer base and generating profits. Relations between operational and profit efficiencies and also transactional and operational efficiencies were identified. Comparison of different dimensions allows us to see superior and inferior branches. They found positive links between operational and profit efficiency and also between transactional and operational efficiency. Service quality is positively related with operational and profit efficiency.

Giokas (2008), also studied the efficiency of 44 branches in Greece by searching three perspectives: Efficiency in managing the economic record of the branches (production efficiency), efficiency in meeting the demand for transactions with customers (transaction efficiency) and efficiency in generating profits (profit efficiency). All models indicated that there is a scope for substantial efficiency improvements and again all models identified essentially the same worst performing branches.

Gaganis *et al* .,(2009), in first stage, examined the profit efficiency, the effect of risk factor (loan loss provisions) on profit efficiency and the Total Factor Productivity (TFP) change. In the second stage they analyzed the impact of some internal and external parameters, such as personnel, income per capita, loans to total assets ratio, loans to deposit ratio, return on assets, on efficiency.

Paradi *et al.,* (2010), evaluated the bank branch efficiency in two stages. From the point that a single

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perspective evaluation cannot fully reflect a branch's multi-function nature, they first measured production, profitability and intermediation efficiency of branches and then aggregated the results with modified Slack Based Model to generate a composite performance index for each branch.

MATERIAL AND METHODS

The pooled data collection is to assess the impact of regulation on performance of cement companies in Tamil Nadu over the time horizon viz., 1996-97 to 2005-06**.** The approach to macroeconomic variables is time series. The design of the study is based on the secondary sources of information on financial data. The secondary data is practically, a quantitative method that requires standardized information in order to define or describe variables or to study the relationships between the variables.

The data was tested for suitability using simple statistical tools such as standard deviation, standard error of the sample. Due to non- accessibility of sensitive company data, the effect of window dressing could not be ascertained. However , Data was accepted as these were frequently inspected by SEBI and Institute of Charted Accountants of India . The study, it was felt, will be useful if the random sample drawn from the population of cement industry in the state of Tamil Nadu. In Tamil Nadu, there are eight Major cement units.

The ACC Ltd is a multi – product and Multi – unit company which did not furnish data exclusively for the Cement and hence it is not included in this study. All other cement units in the state have been covered by the present study which is India Cements Limited (ICL), Dalmia Cement (Bharat) Limited (DCL), Madras Cements Limited (MCL) and Chettinadu Cement Corporation Limited (CCCL). Data first analysed and experimented using non- parametric econometric Data Envelopment Analysis (DEA) programming approach for Scale efficiency.

RESULTS AND DISCUSSION

The efficient years (1996, 1999 and 2005) have scores one and are shown in Table (1) and Fig.1. The value 0.8801 is the inefficient score of the year 1998 means that its inputs can simultaneously be reduced by a factor of 11.99%. The efficient years (1996-1998, 2002, 2003 and 2005) have scores one and are shown in Table 2 and Fig. 2. The value 0.9467 is the inefficient score of the year 2004 means that its inputs can simultaneously be reduced by a factor of 5.33%. Table 1 and Fig.3 reveal the efficiency score of Madras Cements Limited (MCL). The efficient years (1996-1999 and 2001-2003) have scores one and are shown in Table (1) and Fig. (3). The value 0.8987 is the inefficient score of the year 2005 means that its inputs can simultaneously be reduced by a factor of 10.13%. Table (1) and Fig. 4 reveal the efficiency scores of Chettinadu Cement Corporation Limited (CCCL).

The efficient years (1996, 1998, 2003 and 2005) have scored one and are shown in Table (1) and Fig. (4). The value 0.8987 is the inefficient score of the year 2005

Table 1 Cost Efficiency Score of India Cements Limited (ICL), Dalmia Cement (Bharat) Limited (DCL), Madras Cements Limited (MCL), Chettinadu Cement Corporation Limited (CCCL) and Sample Total of cement industry in Tamil Nadu.

Efficiency Scores					
Year/ Company	**ICL**	**DCL**	**MCL**	**CCCL**	**Sample Industry**
1996	1.0000	1.0000	1.0000	1.0000	1.0000
1997	0.9762	1.0000	1.0000	0.9876	1.0000
1998	0.8801	1.0000	1.0000	1.0000	1.0000
1999	1.0000	0.9356	1.0000	0.8864	1.0000
2000	0.9216	0.9563	0.9485	0.8969	1.0000
2001	0.8151	0.9913	1.0000	0.7866	0.9524
2002	0.8164	1.0000	1.0000	0.8651	0.9711
2003	0.9177	1.0000	1.0000	1.0000	0.9907
2004	0.8460	0.9467	0.9754	0.9982	0.9668
2005	1.0000	1.0000	0.8987	1.0000	1.0000

Inputs: Manufacturing cost,Power,Staff Compensation,Other Administration
cost, Selling cost and Interest
Output: Sales
Model : Input oriented model
Scale : Constant returns- to- Scale

Source: Published Annual Reports of the companies, KonSI DEA Analysis for Benchmarking Software Professional Version.

means that its inputs can simultaneously be reduced by a factor of 1- 0.7866, i.e. 21.34 %. The author concludes Contrary to the industrial trend, the Madras Cement outperformed other cement companies in Tamil Nadu through successful cost management strategies, efficient Supply Chain Management (SCM), optimal utilization of man power and control of marketing expenditures. In order to become efficient cost control, the cement industry has to maintain proper Supply Chain Management (SCM).

CONCLUSION

The efficiency score table I, input/output and slack tables II &III of Data Envelopment Analysis clearly bring out that, the cement industry being most power intensive sector, could not control the cost efficiently in terms of value realized through sales. From 2001-2002 to 2004-05, the costs are on the north ward movement (increasing trend). The cost of funds, administrative expenses has gone up significantly affecting the bottom-line of the cement industry. Cost of funds have increased significantly during 2001-2004 which can be attributed to non accessibility of bank finance, inability of the industry to mobilize funds through Initial Public Offering (IPO). The industry has to depend on more costly source of funds i.e. unsecured loans. The input cost have also gone up like rise in raw material prices affecting the efficiency of production units, raising employee compensation has been due to increasing trends across other industries. The industry could have become efficient if the

Table 2 Virtual inputs/ outputs – Industry

year	Manufactu ring		Power and fuel		Compen sation		Other admin		Selling exp		Interest		Sales	
1995-96	343573.53	*0.00*	38418.66	*0.00*	14269.48	*0.00*	22727.77	*0.00*	94358.93	*0.00*	12631.07	*0.00*	152462.62	*0.00*
1996-97	362378.25	*0.00*	41260.61	*0.00*	16618.91	*0.00*	25806.71	*0.00*	100039.87	*0.00*	14505.45	*0.00*	163094.55	*0.00*
1997-98	399233.31	*0.00*	47602.47	*0.00*	18227.48	*0.00*	26938.25	*0.00*	117093.09	*0.00*	18889.32	*0.00*	182022.86	*0.00*
1998-99	506972.75	*0.00*	55875.54	*0.00*	35392.96	*0.00*	30190.41	*0.00*	163864.69	*0.00*	27233.08	*0.00*	236965.33	*0.00*
1999-00	525987.31	*0.00*	60610.55	*0.00*	20663.42	*0.00*	69371.49	*0.00*	214420.89	*0.00*	28866.51	*0.00*	248903.03	*0.00*
2000-01	506497.52	*0.05*	58364.70	*0.05*	19897.76	*0.09*	66801.02	*0.10*	206475.80	*0.06*	27796.90	*0.12*	239680.24	*0.00*
2001-02	500626.27	*0.05*	57308.72	*0.03*	21481.47	*0.03*	60114.81	*0.16*	195679.62	*0.03*	26924.22	*0.27*	235782.41	*0.00*
2002-03	549686.30	*0.01*	63778.06	*0.01*	22514.90	*0.01*	58453.39	*0.23*	179744.28	*0.01*	22846.09	*0.42*	255174.93	*0.00*
2003-04	569902.65	*0.03*	66405.08	*0.07*	22834.29	*0.03*	67998.31	*0.21*	202376.77	*0.03*	25913.06	*0.11*	267541.10	*0.00*
2004-05	730845.31	*0.00*	87352.27	*0.00*	22839.46	*0.00*	93880.69	*0.00*	236980.84	*0.00*	25959.84	*0.00*	341425.59	*0.00*

Source: *KonSI DEA Analysis for Benchmarking Software Professional Version.*

Table 3 Input and output slacks

Year	Manufactu ring expense	Power and fuel	Compen sation	Other administration expenses	Selling expenses	Interest	Sales
1996-97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1997-98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1998-99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1999-00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2000-01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2001-02	0.00	176.35	998.78	4,169.63	2,376.89	2,200.52	0.00
2002-03	11,014.10	0.00	0.00	9,339.16	0.00	8,710.55	0.00
2003-04	0.00	0.00	0.00	16,771.07	0.00	16,020.46	0.00
2004-05	0.00	2,289.55	0.00	14,736.22	0.00	2,126.00	0.00
2005-06	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: KonSI DEA Analysis for Benchmarking Software Professional Version.

administration cost like staff welfare expenses and bonus are brought down through various retirement schemes.

The high cost of finance could have been avoided through mobilizing funds through right shares and other internal avenues. Compared to the industrial level performance as far as control of cost is concerned, the

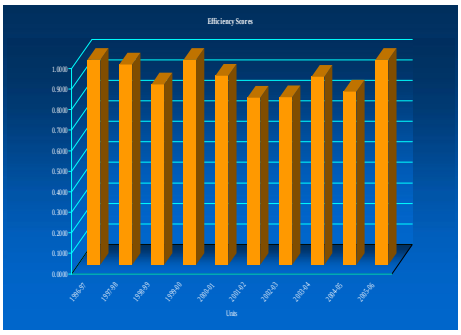

Fig.1 Cost Efficiency score of India Cements Limited

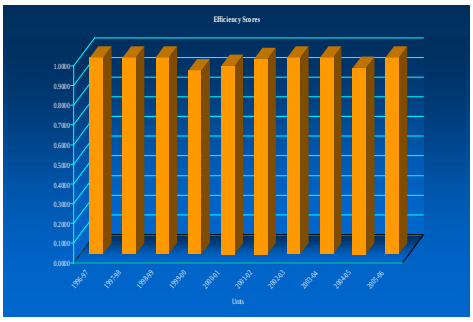

Fig.2 Cost Efficiency score of Dalmia Cement (Bharat) Limited

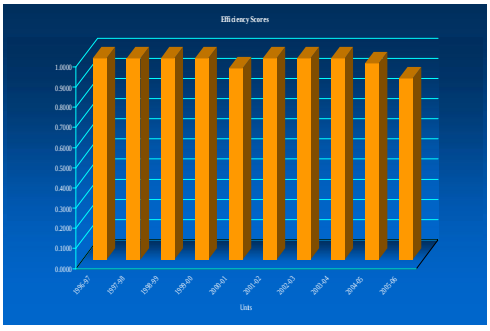

Fig: 3 Cost Efficiency score of Madras Cements Limited

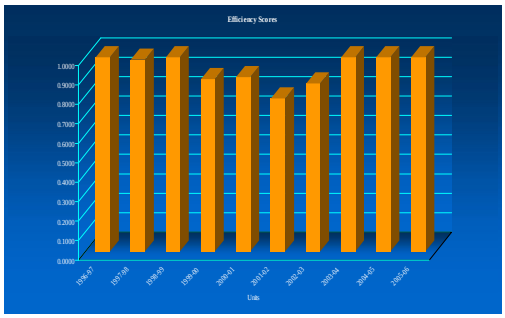

Fig.4 Cost Efficiency score of Chettinadu Cement Corporation Limited.

Fig.5 Cost Efficiency score of Cement industry in Tamil Nadu

individual cement companies' performance is far from satisfactory. At micro level, India cement has failed to rein over raising cost in 1996-1997, 1997-2000, and 2005-2006. The bottom-line of the company is affected mainly because of raising manufacturing expenses, staff expenses and other administration expenses. India cement could have reduced the manufacturing expenses had it formulated supply chain management strategies in tune with industrial trend. Due to failure to rein over cost, India cement has become inefficient insofar as cost efficiency is concerned. The researcher concludes that the cement industry in Tamilnadu should adopt best cost management practices for sustainability and growth.

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