EVALUATING COST EFFICIENCY: A COMPARATIVE STUDY OF PUBLIC LIMITED CHEMICAL COMPANIES IN KERALA

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Abstract

Efficiency is the ability to produce maximum output with available input. It is achieving the maximum output with minimum material, money, energy, and effort. Efficiency Analysis is a yardstick to measure the performance of a business organization in all terms. The concept of cost efficiency indicates how much a company should minimize its costs while producing the same level of output. This paper analyzes the cost efficiency of two major public chemical companies in Kerala over the period 2012-2022. The main objectives of this study are to analyse the cost efficiency of selected companies and its comparison. The present study has used the Data Envelopment Analysis (DEA) model to analyse the cost efficiency of the respective companies. DEA is a nonparametric cost efficiency model used to analyse the relative efficiency of Decision Making Units (DMUs). The study adopted the DEA model (input-oriented) with the Variable Returns to Scale (VRS) and the Constant returns to Scale (CRS) assumptions. It is found that both companies are operating under increasing RTS and the cost efficiencies of KMML are better and more stable than TTPL. The rising RTS indicates that there are opportunities for the business to reach a stable level of productivity.

Keywords:- Cost Efficiency, Public Sector Undertaking, Data Envelopment Analysis (DEA), Variable Returns to Scale (VRS), Constant Returns to Scale (CRS), Scale Efficiency

Efficiency is the optimal use of resources to provide the greatest possible amount of output. It involves selecting alternatives that use the fewest resources to yield the desired results. Efficiency measures how effectively an organization allocates its resources for producing high-quality goods and services at the lowest cost.

An organization can be regarded as inefficient if it uses an improper combination of inputs given their pricing (allocative inefficient), produces less than the maximum output from a given set of inputs, or uses more input than is necessary for a given level of output

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(technical inefficiency) (Shen et al., 2009). An efficient organisation can operate at maximum efficiency with high profitability and is capable of assuming significant risks and challenges. Customers' faith, confidence, and loyalty in a company can be maintained when a company offers them more qualitative and reliable products or services at attractive and competitive prices.

Cost efficiency and other aspects of the business's success are influenced by several internal and external factors. The internal factors that the firm will influence its costs are management, financial condition, transparency, and corporate accountability, all of which are fundamental to the company's internal market environment. There are some external factors like taxation, inflation, credit interest rates, financial stability, and Government regulation that also affect the cost and resource requirements of a business organisation (Narawish et al., 2022). The concept of cost efficiency shows how much a business can reduce costs while providing the same quantity of products and services. Cost efficiency compares the ratio of the actual costs of the company being calculated to the costs of a fully efficient company with the same input prices and output quantities (Cummins et al., 2010).

Achieving cost efficiency is very important for all types of businesses in both public and private sectors in all countries. Kerala is trying to position itself as a growing industrial hub, thus it's critical to understand the dynamics of cost efficiency in all the sectors. The chemical sector in Kerala has grown to be a major driver of the state's economic expansion. Thus, it's important to understand the dynamics of cost efficiency in the chemical industry to maximize resource allocation and improve total production. The procurement of raw materials, power consumption, labour costs, and regulatory compliance are greatly influence how chemical companies manage costs and allocate their resources. Cost efficiency is a crucial performance indicator for the chemical industry that includes a comprehensive analysis of production processes, resource allocation, and overall operational effectiveness.

This study aims to analyse the cost efficiency of KMML and TTPL a Government-owned companies, operating in the chemical industry of Kerala. The results of this study will provide insightful information that can guide proper resource allocation, cost reduction, strategic decision-making, promote operational enhancements, and encourage sustainable growth in the chemical sector.

Objectives of the Study

- To analyse the cost efficiency of KMML and TTPL.
- To compare the cost efficiency of KMML and TTPL.

Scope of the study

Efficient resource management and cost control ensure sustainable competitiveness and promote long-term growth in the manufacturing industry. Cost efficiency is a performance indicator for the industry that includes a

comprehensive analysis of production processes, resource allocation, and overall operational effectiveness. Understanding the dynamics of cost efficiency in the all industry is significant to maximize resource allocation and improve total production. The scope of the study is limited to two chemical companies operated in Kerala. KMML and TTPL are the sample companies selected for the study. And the period of study is limited to 2012-13 to 2021-22.The study is restricted to the following aspects:

- Cost efficiency analysis and its comparison of KMML and TTPL.

Significance of the study

In this cut-throat competitive world providing quality products and services at reasonable price is very important. Only a company which focuses on cost control can achieve cost efficiency and can offer products and services at low price. A cost-efficient company can reduce costs and increase profit margin. Cost efficiency compares the actual cost of producing a given level of output to the lowest cost required to produce the same level. Comparing cost efficiency of companies in the same industry helps them to uncover potential opportunities to balance cost and output. For a public sector undertaking focused on public welfare, cost efficiency analysis very important to evaluate the efficiency of various policies and projects that deliver maximum value for money. The present study analyse and compare the cost efficiency of two public limited companies in Kerala from 2012-13 to 2021-22.The results of this study will provide insightful information that can guide proper resource allocation, cost reduction, strategic decision-making.

Statement of the Problem

An efficient organization can provide quality products at reasonable prices which help to ensure long-term success and sustainability in the market. An organization can be considered inefficient if it uses an improper combination of inputs given their pricing, produces less than the maximum output from a given set of inputs, or consumes more input than is necessary for a given level of output. A cost efficient company can manage risk in balancing between cost and performance and can provide quality products and services at reasonable price than their competitors. Whether in public, private or non-profit sectors, cost efficiency leads to improved financial performance, strategic resource allocation, and enhanced service delivery. The chemical sector in Kerala has grown to be a major driver of the state's economic expansion, promoting industrial development and the creation of jobs. Thus, it's important to understand the dynamics of cost efficiency in the chemical industry to maximize resource allocation and improve total production. This study aims to analyse the cost efficiency of KMML and TTPL a Government-owned companies, operating in the chemical industry of Kerala.

Research Design

The study is based on secondary data. The annual review reports of Public Enterprises published by the Bureau of Public Enterprises, Government of Kerala provide the duly audited Profit and Loss Account and Balance Sheet of Public

Sector Undertakings in Kerala. The data were also collected from the official websites of the corporation, Economic Review of Kerala, magazines, journals, etc.

Period of Study

The study was conducted for 10 years. The duly audited secondary data from 2012-13 to 2021-22 is collected for the study.

Variables selected for the study

Profit and Loss account of the selected enterprises, form the database for the study. Total Cost, Turnover and Total Revenue were the variables used in this analysis.

Statistical Tools

The present study has used the Data Envelopment Analysis (DEA) model to analyse the cost efficiency of the respective companies. DEA is a nonparametric cost efficiency model used to analyse the relative efficiency of Decision-making Units (DMUs). KMML and EICL constitute the DMUs in this study. The study adopted the DEA model (input-oriented) with Variable Returns to Scale (VRS) and Constant returns to Scale (CRS) assumption.

Review of Literature

In today's cut-throat competition world, companies need to achieve efficiency in all aspects. Efficiency refers to the ability to achieve the maximum output with minimum material, money, energy, and effort. The study (Bhatia & Mahendru, 2018) analysed that, the cost efficiency of scheduled commercial banks in India. The cost efficiency analysis helps to identify the best-performing company and it helps them to implement cost reduction strategies in the future. The country-specific environmental factors ought to be included in the common cost frontier. In the absence of this, the predicted efficiency level would be too low. The article (Shen et al., 2009) found that, the factors which led to inefficiencies are not only related to managerial ability but also many external factors peculiar to a country are contributing to it. Cost efficiency analysis enables a company to become more basic in the case of financial uncertainty. It is an important aspect of a company's decision-making process. (Narawish et al., 2022) found that cost efficiency is based on both external and internal factors of a business environment. They concluded that the company with more shareholder privileges and fewer disclosures offers the same level of cost-effectiveness as the one with fewer shareholder rights and a more open approach to transparency. DEA is a useful tool for performance analysis of various industries. A plethora of more DEA techniques are available for evaluating DMU effectiveness about specific goals and objectives. (Asmild et al., 2007) analysed that, overall effectiveness assesses the extent to which a specific set of market pricing has been met about a behavioral or organizational aim, like cost minimization. The size and specialization of a company affect the inefficiencies of firms. The study by (Rai, 1996) found that small firms and single or specialized firms are more cost-efficient than any other size of firm, especially the large-sized firms that offer a combination of products and services. The DEA technique can be used as an

effective tool to estimate potential cost savings. The article (Thanassoulis, 2000) found that, choosing the input-output variables is very important in DEA assessment.

Data Envelopment Analysis (DEA)

Data Envelopment Analysis (DEA) is a non-parametric mathematical programming approach used to construct a piecewise surface over data for calculating efficiencies(Coelli, n.d.).This approach assesses the effectiveness of a group of entities that transform multiple inputs into multiple outputs, such as businesses, organizations, or departments. DEA compares the inputs and outputs of various organizations to determine how efficient they are. It also assesses how well each entity uses its inputs to produce desired outputs. DEA is most applied when there are multiple inputs and outputs and the functional link between inputs and outputs is not explicitly stated. DEA uses mathematical programming to build frontiers, calculate efficiency scores, and find performance benchmarks for inefficient entities. It is useful in many domains where evaluating and enhancing efficiency across similar entities is essential, including banking, healthcare, education, and more. DEA gained prominence in 1978 with Charnes, Cooper, and Rhodes' model, which assumed an input orientation with Constant Returns to Scale (CRS). Alternative sets of assumptions have been examined in later publications. Banker, Charnes, and Cooper (1984) proposed a Variable Returns to Scale (VRS) model. With DEA we can measure technical efficiency, pure technical efficiency, scale efficiency, cost efficiency, revenue efficiency, and profit efficiency(Bhatia & Mahendru, 2018). Cost efficiency considered an input-oriented model as it minimizes inputs at a particular level of output quantities given the input prices. With the use of DEA, Technical Efficiency (input-oriented) may be divided into two halves, namely Pure Technical Efficiency (PTE) and Scale Efficiency (SE). DEA also measures the RTS or Returns to Scale measure whether the DMU operating at decreasing return to scale (DRS) or Increasing Returns to Scale (IRS) or Constant Returns to Scale (CRS).

The mathematical formula used to measure cost efficiency is:

$$Min = \sum_{r=1}^{m} Pi^{o} X_{io}$$

$\sum_{j=1}^{n} \lambda_j X_{ij} \leq X_{io}$ i=1,2,…..m

$\sum_{i=1}^{n} \lambda_j X_{ij} \geq Y_{ro}$ r=1,2,…..s

$\lambda_j X_{io} \geq 0$ $\sum_{i=1}^{n} \lambda_j = 1$

Where,

n = DMU observation

j=n^{th} DMU

m= input observation

r = s^{th} output

i = m^{th} input

y_{ro}= r^{th} output that maximize revenue for DMU0

x_{io}= i^{th} input that minimize cost for DMU0

y_{rj}= s^{th} output for nth DMU

x_{ij}=m^{th} input for nth DMU

λ_j= non-negative scalars

In this study, the input-oriented DEA model was used to measure the cost efficiency in the chemical sector using the VRS and CRS assumptions. It gauges efficiency by reducing the input values. The CCR model uses CRS assumptions; the BCC model uses VRS assumptions. Technical efficiency is represented by CRS, and pure technical efficiency is represented by VRS. Any result below the maximum efficiency score of 1 denotes decreased efficiency.

Results and Discussions

The mean scale efficiency of TTPL was highest in the year 2021-22 and lowest in the year 2015-16. The average CRS or CCR model efficiency is 70 per cent and the average VRS efficiency or BCC model was 89 per cent. The analysis revealed that TTPL should contract its input by 11 per cent to 30 per cent to operate efficiently. During the chosen period the company's efficiency was quite unstable. Till 2016-17 it shows very dynamic fluctuation in their efficiency score but after 2016-17 it ranges between 80-86 per cent. Throughout the study period, TTPL operates under an increasing return to scale (RTS). The rising RTS indicates that there are opportunities for the business to reach a stable level of productivity.

The mean scale efficiency of KMML was highest in the year 2018-19. The average efficiency of the VRS or BCC model was 85 per cent, and the average efficiency of the CRS or CCR model was

Table 1.1

Descriptions of input and output variables

Input Variable	Output Variable	Unit of Measurement
Total Cost	Turnover Total Revenue	Rupees

Source: Researcher's contribution

Table 1.2

Cost Efficiency of TTPL

Year	CRS Efficiency	VRS Efficiency	Scale Efficiency	RTS
2012-13	0.68791	0.84342	0.81562	Increasing
2013-14	0.69848	0.87922	0.79443	Increasing
2014-15	0.60882	0.93076	0.65411	Increasing
2015-16	0.64083	1.00000	0.64083	Increasing
2016-17	0.75413	1.00000	0.75413	Increasing
2017-18	0.82826	1.00000	0.82826	Increasing
2018-19	0.76274	0.88931	0.85768	Increasing
2019-20	0.70349	0.85114	0.82653	Increasing
2020-21	0.52782	0.65530	0.80546	Increasing
2021-22	0.78025	0.90586	0.86134	Increasing
Mean	**0.69927**	**0.89550**	**0.78384**	

Source: Researcher's Calculation

Table 1.3

Cost Efficiency of KMML

Year	CRS Efficiency	VRS Efficiency	Scale Efficiency	RTS
2012-13	0.83311	0.86477	0.95024	Increasing
2013-14	0.75834	0.77758	0.966215	Increasing
2014-15	0.71262	0.74071	0.94849	Increasing
2015-16	0.77700	0.81039	0.944084	Increasing
2016-17	0.80405	0.82431	0.966439	Increasing
2017-18	0.95985	0.97802	0.974582	Increasing
2018-19	0.89061	0.90060	0.984766	Increasing
2019-20	0.76223	0.77908	0.972065	Increasing
2020-21	0.84094	0.85296	0.980693	Increasing
2021-22	1.00000	1.00000	1	Constant
Mean	**0.83387**	**0.85284**	**0.976955**	

Source: Researcher's Calculation

83 per cent. The analysis revealed that the company should contract its input by 17 per cent to 14 per cent to operate efficiently. During the study period, the efficiency of KMML was quite stable. KMML is operating under the increasing return to scale except in the year 2021-22. During the year 2021-22, the company achieved constant RTS showing consistent improvement in their performance.

From the analysis, it is found that both companies are operating under increasing RTS. The rising RTS indicates that there are opportunities for the business to reach a stable level of productivity. However, the cost efficiencies of KMML are better and more stable than TTPL. The primary cause of TTPL's decreasing revenue is the increase in cost of production due to the increased cost of raw materials. There is a noticeable variation in the efficiency of TTPL from 2013 to 2019. The increase in the production and sales realisation of Sulphuric Acid helped the company to turnaround in the recent years.

Suggestions

The following suggestions are put forward based on study;

1. As a manufacturing company both companies should ensure the proper utilization of its inputs, the underutilization of resources affect the efficiency of their operations.
2. As the primary cause of decreasing revenue of TTPL is due to increased cost of production. Therefore, the company should make necessary efforts to reduce the cost of production especially the cost of raw material through better negotiations with suppliers.
3. The increasing RTS of both the companies indicates that there are opportunities for the business to achieve the desired level of productivity and increased efficiency. So that the companies should formulate better strategies to utilize their resources more efficiently and cut down unnecessary costs.

4. A separate cost department should be maintained. It will provide adequate support in the better allocation of resources and cost, and can helps to build accountability among all departments.

Conclusion

Cost efficiency is essential for long-term success, competitiveness, sustainability, and financial health of any business. Businesses are better positioned to prosper in the fast-paced, cutthroat business world if they become cost-efficient in their operations. Cost efficiency pertains to comparing what can be accomplished with the same consumption of resources in terms of input with what is actually produced. In essence, cost-efficiency is the ratio of costs to productivity (Menon & Phalachandra, 2018). The DEA is a system, based on linear programming for evaluating the productive efficiency of operating units. The paper analysed the cost efficiency of two public sector chemical companies in Kerala.

From the study, it is found that both companies are operating under increasing RTS. The rising RTS indicates that there are opportunities for the business to reach a stable level of productivity. During the study period, the efficiency of KMML was quite stable. There is a noticeable variation in the efficiency of TTPL from 2013-19.

It can be concluded from the study that, the cost efficiencies of KMML are better and more stable than TTPL. The primary cause of TTPL's decreasing revenue is the increase in cost of production due to the increased cost of raw materials and the competition from the Chinese market has also adversely affected their profitability. TTPL's declining performance in 2020-21is mainly due to a decline in production attributable to the bottleneck in the treatment of effluent in the neutralisation plant(Centre for Management Development, 2022)

Businesses that are flexible and sensitive to shifting market conditions can efficiently modify their operations and cut down on wasteful spending. Competitive pricing made possible by cost efficiency draws in more customers and increases market share. Enhanced product/service quality and more competitive pricing without raising prices, will raise customer satisfaction and ensure long term sustainability.

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