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A STUDY ON COST EFFECTIVENESS AND PROFITABILITY OF INDIAN AUTOMOBILE INDUSTRIES

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ABSTRACT

One of the most important aspects of measuring a firm's performance is through its effectiveness, of which the firm is expected to achieve effective cost reduction, thereby attractive profitability. However, most studies conducted to explore the determinants of automobile companies' efficiency and performance have concentrated on the account of financial information and their components. Therefore, this study analysis the cost efficiency secondary data from the annual financial statements of the five selected automobile companies listed S&P BSE Auto, for a period of 2014 to 2023. To know the efficiency score for both profit and cost, the study used DEA analysis and also multiple regression analysis e views application software used to know the impact on profit and cost on cost inputs and outputs of selected automobile companies. Additionally, the paper recognizes the number of automobile companies operating as leaders and laggards according to Cost Efficiency and its component scores. The results of study show that positive relationship between total cost model and profit model of selected automobile companies in India.

Keywords: *Total cost model, Profit model, Profitability, Automobile Companies.*

1. INTRODUCTION:

In the bustling landscape of the Indian automobile industry, where innovation meets aspiration, a remarkable story of cost effectiveness and profitability unfolds. As the wheels of progress turn, this study ventures into the heart of this dynamic sector to unravel the intricate interplay between financial efficiency and sustainable growth. From the sprawling manufacturing plants to the fast-paced research and development centres, Indian automakers have not only carved a niche for themselves in a fiercely competitive global market but have also managed to strike a delicate balance between cost optimization and profitable outcomes.

In recent years, the Indian automotive landscape has witnessed a remarkable transformation, fuelled by a growing middle class, urbanization, and evolving consumer preferences. While several factors contribute to the success of the industry, the ability of manufacturers to navigate the intricate web of costs and profits has become a defining characteristic. This study aims to delve deep into the cost-effectiveness strategies employed by Indian automobile companies, shedding light on the key drivers of their profitability and unveiling the innovative approaches that have propelled them to the forefront of the global stage.

Examining the cost effectiveness and profitability of the Indian automobile industry requires a comprehensive understanding of the intricate ecosystem that supports its operations. From the procurement of raw materials and efficient supply chain management to streamlined manufacturing processes and astute marketing strategies, the industry players have embraced a holistic approach towards achieving sustainable profitability. Through meticulous analysis of financial data, market trends, and industry best practices, this study aims to provide valuable insights into the success stories of Indian automakers, illustrating how they have managed to strike a delicate equilibrium between cutting-edge innovation, cost containment, and thriving profitability.

Furthermore, this research endeavours to identify the emerging trends and disruptive technologies that are reshaping the cost dynamics of the Indian automobile industry. The advent of electric vehicles, autonomous driving technologies, and the growing emphasis on sustainability pose unique challenges and opportunities for automakers. By examining the strategies employed by industry leaders and analysing their impact on the cost structure and profitability, this study aims to offer a roadmap for sustainable growth in an increasingly dynamic and competitive landscape.

As we embark on this journey to unravel the cost effectiveness and profitability of Indian automobile industries, we invite you to delve into the intricate workings of this vibrant sector, where innovation, efficiency, and profitability converge to shape the future of mobility. By exploring the drivers of success and the challenges faced by Indian automakers, this study seeks to illuminate the path towards a sustainable and prosperous future for one of India's most crucial industries.

Through a meticulous examination of financial data, industry trends, and case studies, this study aims to provide a comprehensive understanding of the strategies employed by Indian automakers

to achieve cost effectiveness and profitability. Join us as we unveil the untold stories behind the financial success of the Indian automobile industry and navigate the winding roads that lead to sustained growth and prosperity.

2. SIGNIFICANCE OF THE STUDY:

The study on the cost-effectiveness and profitability of the Indian automobile industry holds immense significance for various stakeholders. Understanding the cost-effectiveness within this sector is crucial for industry players, policymakers, and investors. It provides insights into the efficiency of resource utilization, production processes, and overall operational effectiveness. For companies, the study can guide strategic decision-making, helping them optimize costs, enhance profitability, and stay competitive in a dynamic market. Policymakers can use the findings to formulate regulations that promote a conducive environment for sustainable growth. Investors gain valuable information for making informed investment decisions based on the industry's financial health. Additionally, the study contributes to the broader economic landscape by shedding light on a key sector, influencing employment, trade balances, and overall economic development. In essence, this research not only benefits the automobile industry but also has far-reaching implications for the economic ecosystem of India.

3. LITERATURE REVIEW:

1. **Segal, (2002)** Defined Input and Output for life insurance business used in cost-effectiveness analysis of life insurance business. Input is operating costs which are classified into labour-related expenses, capital expenses, and materials consisting all other expenses. Output is number of life policies sold during the year.
2. **Gafni et.al. (2006)** Explained that the value of λ is not appropriately determining as well as using in CEA. As a result of this, the threshold approach has led to decisions that resulted in increased expenditures without any evidence of increases in total gains.
3. **McEwan, (2012)** Found that cost-effectiveness analysis is a straightforward but under-utilized tool for determining which of two or more interventions provides a unit of effect at least cost.



4. **Jain, (2015)** Measured cost-effectiveness of training programs in insurance sector of India through costbenefit ratio. Finding shows that training programs in public insurance sector is more cost-effective as compared to private insurance sector.
5. **Svensson et.al, (2017)** Found that the different perspective on mortality and morbidity effects is the most important difference between cost-benefit and cost-effectiveness analysis.
6. **Jaganathan et.al, (2019)** The study aimed to investigate the progress and evolution of the automobile industry in India. It delves into assessing various aspects, including the current state, growth patterns, and challenges faced by the Indian automobile sector. The researchers emphasize the industry's pivotal role in creating top-notch products, ensuring cost competitiveness, and improving labor and capital productivity. By collaborating with manufacturers and adhering to government policies, they anticipate India becoming a global hub for designing and manufacturing automobiles. The study identifies key challenges such as rising fuel prices, high-interest rates, and increased costs due to elevated commodity prices, impacting sentiments in the domestic market. Overall, the research highlights the need for collaborative efforts and policy alignment to elevate the Indian Automotive Industry's global standing.
7. **Adegbie Folajimi Festus et.al, (2020)** This research examined how managing available funds impacts the long-term success of oil and gas companies in Nigeria. Using a research design called ex-post facto, the study found that the financial health of these companies is significantly influenced by how well they handle their funds. The results indicate that effective liquidity management positively affects both profitability and economic value added. In conclusion, the study suggests that how companies manage their cash flow plays a crucial role in their overall sustainability. The recommendations include advising shareholders, managers, policymakers, and regulators to pay close attention to liquidity management and the timing of credit transactions for sustained corporate success.
8. **Bhadrapa Haralayya et.al, (2021)** explores cost efficiency (CE) in India and other countries. CE is divided into two parts: technical efficiency (TE), which focuses on using minimum inputs for existing output or maximizing output from given inputs, and allocative efficiency (AE), related to optimal input use based on costs. Technical inefficiency is controlled by management, while allocative inefficiency is influenced by direction but may



not be managed. In simpler terms, the study assesses how well resources are used to produce outputs, considering both quantity (technical efficiency) and cost-effectiveness (allocative efficiency).

9. **Appah Ebimobowei et.al, (2021)** This research empirically investigated the impact of liquidity and profitability ratios on the profit growth of listed oil and gas companies in Nigeria. Employing an ex-post facto and correlation design, data from annual reports spanning 2014 to 2019 were analysed using descriptive, correlation matrix, and multiple regression methods. The findings indicate that various ratios, including current ratio, acid test ratio, gross profit ratio, net profit ratio, net working capital, return on assets, return on equity, and return on capital employed, positively and significantly influence the profit growth of these companies. The study concludes that liquidity and profitability ratios play a substantial role in shaping company growth, recommending the use of financial ratios for assessing corporate profit growth and informing investment decisions.
10. **Umar Heru Setiadi et.al, (2022)** A developing Asian country is shifting its energy industry from oil and gas to electricity and renewables. Government data predicts a drop in oil and gas share from 32% to 20% by 2050 due to increased electrification and diversified energy sources. The company, particularly one of its domestic oil refineries, faces challenges impacting its business. The study concludes that the company needs a strategic plan to overcome these challenges, enhance profits, and stay competitive. Using analyses like VRIO and Business Model Canvas for internal factors, and PESTLE and Porter's Five Forces for external factors, the study suggests Market Development as the top strategy. This involves increasing crude processing capacity and upgrading refinery technology.

4. OBJECTIVES OF THE STUDY:

1. To analyse the cost structure of selected Indian automobile companies.
2. To compare cost effectiveness of selected automobile companies for research period.

4.1. Hypothesis:

H₀: There is no significant impact of total cost on cost input and out puts of selected automobile companies in India.

H₀: There is no significant impact of profit on cost input and out puts of selected automobile companies in India.

4.2. Methodology:

The study employed quantitative research design by using secondary data from the annual financial statements of the five selected automobile companies listed S&P BSE Auto. The period of the study was from 2014-15 to 2022-23 i.e., of 10 years. The study is of both descriptive and analytical in nature in which data were collected from financial statements and then analyses by using e views application software to know the cost effectiveness of selected automobile companies in India.

4.3. Population and Sample for the study:

The investigated population is all the automobile companies of India listed in S&P BSE Auto. Out which 5 top companies are selected they are:

Table 1 List of automobile companies of India listed in S&P BSE Auto

Sl. no	Company	Market capitalization (crores)
1	Mahindra & Mahindra Ltd.	1,91,043
2	Bajaj Auto	1,60,861
3	Eicher Motor Limited	1,05,212
4	TVS Motor company Limited	81,931
5	Ashok Leyland Limited	52,307

Source: Annual Reports of the Selected Automobiles Companies.

These companies are selected based on their respective market capitalisation as seen from the above table.

Tools used: To know the efficiency score for both profit and cost, the study used DEA analysis and also multiple regression analysis e views application software used to know the impact on profit and cost on cost inputs and outputs of selected automobile companies.

Estimation of technical efficiency scores: To estimate efficiency scores for each observation, a DEA estimator is used. The DEA approach usually assumes that all decision-making units (DMU) within a sample have access to the same technology for transforming a vector of N inputs, x , into a vector of M outputs, y . The assumption is that technology can be characterised by the technology set, T , defined as:

$$T = \{(x, y) \in \mathbb{R}^N \times \mathbb{R}^M_+ : x \in \mathbb{R}^N_+ \text{ can produce } y \in \mathbb{R}^M_+\}$$

Table 2 Input and Output Variables

Variable	Symbol	Name	Description
Dependent variables	TC	Total cost	Total of all costs
	EBIT	Profit	Profit before tax
Inputs	W1	Material Cost	
	W2	Employee benefits expenses	
	W3	Finance cost	
Output	Y1	investment interest	
	Y2	dividend income	
	Y3	other income	

Source: Authors' idea

To critically examine the efficiency of selected automobile companies in India, a panel data method was used. To examine whether the fixed or random effects model should be used the Hausman test was run. The Hausman test basically tests whether the unique errors are correlated with the regressors. The Hausman test revealed that, the probability value (p) was less than the significance level (0.05), hence the null hypothesis (random effect) was rejected and the fixed effect model was then used to run regression.

Measurement of efficiency and Analytical method:

Two main types of efficiency modules are used to analysis the efficiency level they are profit efficiency and cost efficiency. The study adopted both methods to measure the efficiency of the automobile companies in India. In cost efficiency measures the how companies minimize their cost where the minimum expenses are determined by the best performance in the dataset. The cost of a firm (C) depends on the output (y), the price of inputs (w), the level of cost inefficiency (u) and a set of random factors (v) which incorporate the effect of errors in the measurements of variables. Thus, the cost function is expressed functionally as:

$$C = C(y, w, u, v)$$

The cost efficiency for firm i at time t can be calculated as:

$$\text{Cost efficiency}_{it} = \frac{E(C_i:u=0.WY)}{E(C_i:u.WY)}$$

Where C_i are total cost incurred i , w and y are the input cost and output of i respectively. The numerator reflects the minimum cost achievable by the companies and denominator shows actual costs of i given the actual level of efficiency.

On the other side, profit efficiency is a broader concept than cost efficiency since it takes into account the effects of the choice of certain vectors of production, both on costs and on revenues. Given the input and output (w) and (p) respectively, the firm maximizes profits by adjusting the amounts of inputs and outputs.

Thus, the profit function can be expressed as:

$$\text{Profit efficiency: } P(w, p, u, v)$$

Empirical out comes:

Analysis of data and results:

Table 3 Descriptive analysis of Input/ Output Variables:

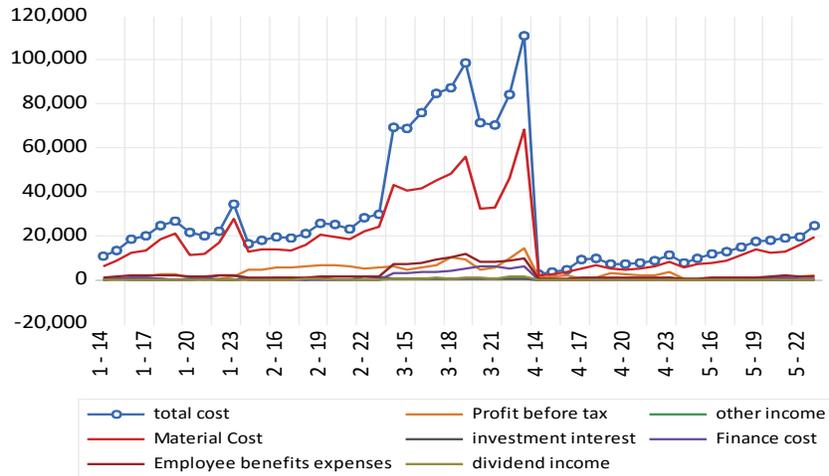
Measures	Dependent variable		Input variables			Output variables		
	Total cost	Pre-tax profit	Material Cost	Employee benefits expenses	Finance cost	Investment interest	Dividend income	Other income
Mean	29625.08	3354.26	18717.77	2607.92	1099.35	272.86	198.29	150.16
Median	19487.8	2248.95	13479.08	1272.50	63.50	86.24	4.84	77.97
Standard Error	3971.07	439.21	2175.33	443.39	262.30	53.91	59.55	36.17
Standard Deviation	28079.70	3105.69	15381.92	3135.25	1854.77	373.52	390.47	255.75
Kurtosis	1.07	1.64	1.51	1.13	1.48	2.66	4.73	12.34
Skewness	1.51	1.24	1.42	1.63	1.67	1.85	2.27	3.36

Minimum	2349.49	-91.22	1819.08	160.90	0.82	1.97	0.00	0.20
Maximum	111169.77	14060.23	68477.97	11563.89	6102.22	1475.34	1607.14	1284.14
Count	50	50	50	50	50	50	50	50

Source: author's calculation using secondary data

The table 3 presented summary of statistics for the dependent, input and output variables of financial measures for a total of 50 observations. The dependent variable "total cost" representing the overall total cost for the entity. On average, the total cost is 29,625.08, with a median value of 19,487.80. The wide standard deviation of 28,079.70 indicates significant variability in total cost among the observations. Moreover, the positive skewness value of 1.51 suggests a moderate right-skewed distribution, implying that a few high-cost are influencing the overall distribution. The dependent variable "Pre-tax profit," representing the earnings before taxes for the entity. On average, the pre-tax profit is 3354.26, with a median value of 2248.95. The wide standard deviation of 3105.69 indicates significant variability in pre-tax profits among the observations. Moreover, the positive skewness value of 1.24 suggests a moderate right-skewed distribution, implying that a few high-profit outliers are influencing the overall distribution

The analysis also covers several input variables contributing to the "Total cost" of operations. These input variables include "Material Cost," "Employee Benefits Expenses," "Finance Cost," and output variables "Investment interest", "Dividend income", "Other income". Among these inputs, "Material Cost" has the highest mean of 18,717.77, while " Finance cost " has the lowest mean of 1099.35. The skewness values for these input variables range from 1.42 to 1.67, indicating mild to moderate right-skewed distributions for each of them. Output variables among "Investment interest" has the highest mean of 272.86, while "Other income" has the lowest mean of 150.16. the skewness values for these output variables range from 1.85 to 3.36 indicating positive moderate right-skewed distribution.



Source: E views

Figure 1 Descriptive analysis of Input/ Output Variables:

Testing of hypothesis

H₀: There is no significant impact of total cost on cost input and out puts of selected automobile companies in India.

Table 4 presented the regression results of the total cost and the output/input variables. The input and output variables of the firms contribute about 99.80% of the variation in the total cost of automobile companies. All the considered input and output variables were found to have a positive impact on total cost of the firms. Material cost, finance cost, employee benefit expenses, dividend income, investment income have significantly positive impact on total cost. In addition, other income even though positive impact on cost, it is not a significant variable to determine total cost. This evident as its p-value (0.5759) is greater than alpha level of 0.05. The below graph shows the residual values of total cost model.

Table 4: Regression results of the Total Cost Model Summary

Dependent Variable: TOTAL_COST
 Method: Panel Least Squares
 Date: 07/21/23 Time: 14:55
 Sample: 2014 2023
 Periods included: 10
 Cross-sections included: 5
 Total panel (balanced) observations: 50

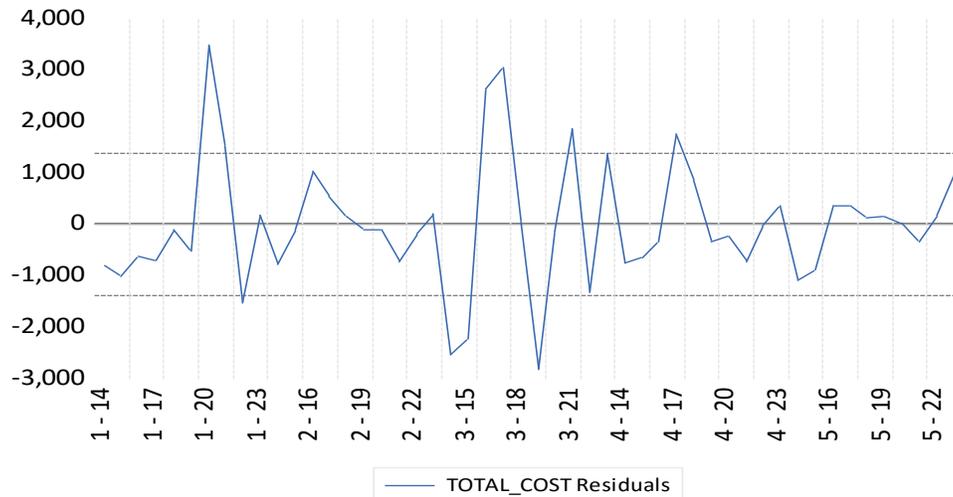
Variable	Coefficient	Std. Error	t-Statistic	Prob.
MATERIAL_COST	0.845343	0.048041	17.59642	0.0000
FINANCE_COST	0.399027	0.394770	1.010785	0.3183
EMPLOYEE_BENEFITS_EXPENSES	3.080405	0.410760	7.499276	0.0000
DIVIDEND_INCOME	5.426673	1.451029	3.739879	0.0006
INVESTMENT_INTEREST	0.780223	0.944479	0.826088	0.4138
OTHER_INCOME	0.536586	0.951080	0.564186	0.5759
C	4119.684	850.6600	4.842927	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.998082	Mean dependent var	29625.08
Adjusted R-squared	0.997590	S.D. dependent var	28079.70
S.E. of regression	1378.380	Akaike info criterion	17.48674
Sum squared resid	74097359	Schwarz criterion	17.90739
Log likelihood	-426.1686	Hannan-Quinn criter.	17.64693
F-statistic	2029.594	Durbin-Watson stat	1.699390
Prob(F-statistic)	0.000000		

Source: Author's employed e views



Source: E views

Figure 2 Residuals Plot of Total Cost

Testing of hypothesis

H₀: There is no significant impact of profit on cost input and out puts of selected automobile companies in India

Table 3 reveals that the regression results of the input/output variables profit before tax. It can be observed that, adjusted coefficient of determination(R^2) is 0.921 which means that the input and output variables account for about 92.1% of the firms profit variance. The study also found that the input and output are collectively significant in determining the profitability of selected automobile companies. The below graph shows the residuals of profit impact model.

Table 5 Regression results of the Profit Model Summary

Dependent Variable: PROFIT_BEFORE_TAX

Method: Panel Least Squares

Date: 07/21/23 Time: 15:39

Sample: 2014 2023

Periods included: 10

Cross-sections included: 5

Total panel (balanced) observations: 50

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OTHER_INCOME	-0.954819	0.601368	-1.587744	0.1204
MATERIAL_COST	0.125630	0.030376	4.135809	0.0002
INVESTMENT_INTEREST	0.422107	0.597195	0.706815	0.4839
FINANCE_COST	-0.391308	0.249613	-1.567659	0.1250
EMPLOYEE_BENEFITS_EXPENSES	0.499145	0.259724	1.921827	0.0620
DIVIDEND_INCOME	3.279618	0.917487	3.574567	0.0010
C	-395.2492	537.8729	-0.734838	0.4668

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.937319	Mean dependent var	3354.260
Adjusted R-squared	0.921246	S.D. dependent var	3105.687
S.E. of regression	871.5508	Akaike info criterion	16.56996
Sum squared resid	29624429	Schwarz criterion	16.99061
Log likelihood	-403.2491	Hannan-Quinn criter.	16.73015
F-statistic	58.31942	Durbin-Watson stat	2.194363
Prob(F-statistic)	0.000000		

Source: Author's employed e views

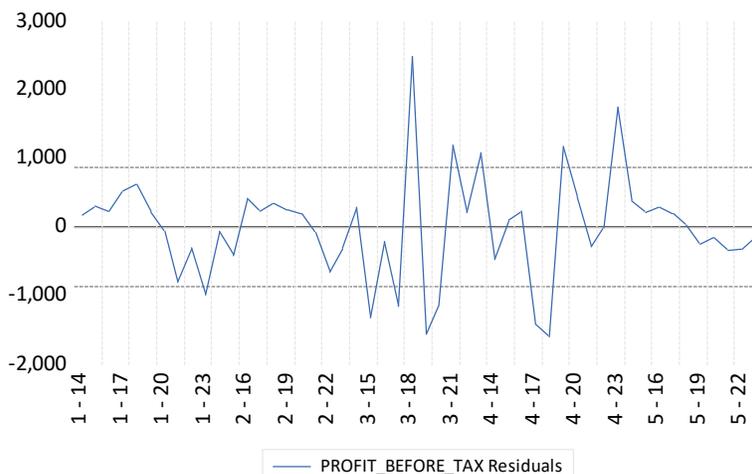


Figure 3 Residuals plot of profit before tax

5. CONCLUSION:

The current study is an attempt to know about the cost-effectiveness of selected automobile companies. For this, researchers used cost-effectiveness analysis by using two important models i.e., cost impact model and profit impact model. The study concludes that the regression analysis of the cost effect model is evident that all the considered input and output variables were found to have a positive impact on the total cost of the firms. Profit model impact on all input and output variables shows a significantly positive impact on all selected variables. The study contributes to the depth of application of the efficiency structure hypothesis to efficiency and performance in Indian automobile companies.

The limitation of this study is the inability to include other external macroeconomic variables which affect the determination of both efficiency and performance. The company's profit may be influenced by not only input and output, but also by its quantity, revenue, the economy scale, or economy of scope. Future studies may sufficiently include control variables to account for firm-level heterogeneities.

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