Analysis of Financial Performance Parameters of Four Automobile Companies in India By MCDM Techniques

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ABSTRACT

A research investigation into the financial performance of selected automobile companies in India examines their overall financial stability by assessing essential indicators such as profitability, liquidity, and solvency. The objective is to uncover patterns, highlight strengths, and pinpoint areas needing improvement within the industry, ultimately providing valuable information for investors and other stakeholders. The study aims to analyze both the financial structure and position of these Indian automobile firms. This type of research concentrates on observing existing conditions as well as exploring potential new insights and interpretations. For this analysis, data was sourced from secondary materials, including annual reports, books, online resources, magazines, and newspapers. The study employed tools of MCDM (Multi Criteria Decision making) focusing mainly on TOPSIS method is employed here. By evaluating the financial performance of the selected companies, this research enhances our understanding of the sector's economic landscape and establishes a foundation for fostering competitiveness and sustainable growth in an ever-evolving global marketplace. The main objective of this study is to analyze the financial performance of four market leader in automobile sector since last 5 years. The company taken for analysis are Tata Motors, Maruti Suzuki, Hyundai and Mahindra & Mahindra.

INTRODUCTION

Automobile industry contributes is a major and significant contributor to Indian economy. It contributes approximately 7.1% to the GDP and employing over 37 million individuals directly and indirectly (Wikipedia). As per the data of 2025 India has ascended as the third largest automobile market globally, just behind China and United States. The industry encompasses a diverse range of vehicles, including two-wheelers, passenger cars, commercial vehicles, and electric vehicles (EVs) (indbiz.gov.in). Notably, India is the world's largest manufacturer of two-wheelers and tractors. Electric vehicles are gaining momentum and will become third largest EMarketer by 2025 (Economic times, Apr 28, 2024). India's automotive market is projected to reach $300 billion by 2026, driven by rising income levels, urbanization, and an expanding middle class. In March 2024, the Indian auto industry produced 2,325,959 units, including passenger vehicles, three-wheelers, two-wheelers, and quadricycles. Passenger vehicles accounted for 368,086 units, three-wheelers 56,723 units, and two-wheelers 1,487,579 domestically. The Indian automotive industry produced 7,394,417 units in Q1 2024, with passenger vehicles, commercial vehicles, three-wheelers, and two-wheelers leading the pack. The industry's growth was fueled by foreign direct investment (FDI), with a cumulative equity FDI inflow of around $35.40 billion between 2000 and 2023. Government initiatives also contributed to growth, with total automobile exports reaching 47,61,487 units in FY23, contributing to the nation's GDP and employing 19 million people. India's transition to electric vehicles (EVs) is gaining momentum, with projections suggesting it will become the third-largest EV market by 2025. This presents a substantial investment opportunity of over $200 billion over the next 8-10 years, with the EV market forecasted to grow at a CAGR of 49% between 2022 and 2030(Economic Times, August 6). Passenger vehicle sales performance In 2024, it was estimated that 82 million passenger vehicles were sold worldwide, a 3% increase over 2023. Approximately 65% of passenger

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car sales were concentrated in important markets including China, the United States, India, Japan, and Germany. China leads the world in passenger vehicle sales with 34%, followed by the United States (18%), India (5.2%), Japan (4.6%), and Germany (3%). India is still the world's third-largest market for passenger cars, after the United States and China.(SIAM-Annual-Report-24-25, n.d.)

Category	2020-21	2021-22	2022-23	2023-24	2024-25
Passenger car	15,41,866	14,67,039	17.47.376	15,48,947	13.53,287
Utility vehicle	10,60,750	14,89,219	20,03,718	25,20,691	27,97,229
Vans	1,08,841	1,13,265	1,39,020	1,49,112	1,51,332
Total Passenger Vehicle	27,11,457	30,69,523	38,90,114	42,18,750	43,01,848

Sources: SIAM-Annual-Report-24-25

LITERATURE REVIEW

This literature review examines the financial performance of Indian automobile companies using various analytical techniques. Multiple studies employ ratio analysis and ANOVA to evaluate key financial indicators such as liquidity, solvency, and profitability (Kavitha S Sharma, 2025; Dr. Kalpesh K. Chauhan, 2023). Advanced multi-criteria decision-making (MCDM) techniques, including fuzzy multi-objective optimization on the basis of ratio analysis (F-MOORA) and fuzzy step-wise weight assessment ratio (F-SWARA), are utilized to assess both accounting-based and value-based financial performance measures ((Agrawal et al., 2024; Jain et al., 2018; Promethee, n.d.)). The automotive sector's significance to India's economic growth is highlighted, with projections indicating it could contribute 12% to GDP by 2026 ((A_Study_of_Investment_Pattern_of_Central, n.d.)). Despite recent challenges, the industry shows resilience and potential for recovery (Samita Mahapatra, 2021). These analyses provide valuable insights for stakeholders and identify areas for improving competitiveness in the global market ((K. S. Sharma, n.d.; M. P. Sharma & Grover, 2016). Finding a company's strengths and shortcomings through financial performance analysis is one way to evaluate its financial health. Balance sheets and profit and loss accounts are the main financial statements upon which it is based. Financial performance can be analyzed with the help of ratio and trend analysis tools. Researchers, creditors, shareholders, directors, and investors are among the stakeholders who utilize it to determine a company's present financial status ((Narayan Konwar, n.d.).

TOPSIS Process is designed as follows:

Step-1 Create an evaluation matrix consisting of m alternatives and n criteria, with the $_{ij}$

Step-2 The matrix $(x)_{mxn}$ is then normalised to form the matrix

$$R = (r_{ij})_{m \times n}$$

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{k-1}^{m} x_{kj}^2}} \text{ , i=1, 2……., m, j=1,2, 3…...,n}$$

$$t_{ij} = r_{ij} . w_j \text{ , } \quad i= 1,2,….m \text{ , } \quad j= 1,2,3,…..n$$

Where $w_j = W_j \ / \sum_{k=1}^{n} W_k$,j = 1.2…..n so that $\sum_{i}^{n} w_i = 1$ and W_j is the original weight given to the indicator v_j , j = 1,2,…n

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Step -4: Determine the worst alternative denoted by (A_w) and the best alternative by (Ab)

$$A_w = \{\max (t_{ij} \mid i= 1,2,\ldots m)\mid j \in J_- \ , \ \min (t_{ij} \mid i= 1,2,\ldots m)\mid j \in J_+ \} \equiv \{ t_{wj} \mid j=1,2,\ldots n\}$$

$$A_b = \{\min (t_{ij} \mid i= 1,2,\ldots m)\mid j \in J_- \ , \ \max (t_{ij} \mid i= 1,2,\ldots m)\mid j \in J_+ \} \equiv \{ t_{bj} \mid j=1,2,\ldots n\}$$

Where

J_- = { j= 1, 2,…n | j } associated with the criteria having negative impact

J_+ = { j= 1, 2,…n | j } associated with the criteria having positive impact

Step -5: calculate L^2 – distance between the target alternative i to the worst condition A_w

$$d_{iw} = \sqrt{\sum_{j=1}^{n}(t_{ij} - t_{wj})^2} \quad i= 1, 2\ldots m$$

and the distance between the alternative i and the best condition A_b

$$d_{ib} = \sqrt{\sum_{j=1}^{n}(t_{ij} - t_{bj})^2} \quad i= 1, 2,\ldots m$$

where d_{iw} and d_{ib} are L^2 -norm distances from the target alternative i to the worst and best condition respectively.

Step -6: calculate the similarity to worst condition:

$S_{iw} = d_{iw} / (d_{iw} + d_{ib})$, $0 \leq s_{iw} \leq 1$, $i = 1,2,\ldots,m$

S_{iw} =1 if and only if the alternative solution is the best condition

S_{iw} =0 if and only if the alternative solution is the worst condition

Step 7: Rank the alternatives according to s_{iw} (i=1,2, 3,,m)

Objectives of the Study

1. To compare the Liquidity position of the five selected Automobile Industry.
2. Assessing the financial performance by Multi Criteria Decision making model (MCDM) using Shannon weight method.

RESEARCH METHODOLOGY

Selection of Sample

To evaluate the financial performances of automobile companies I have selected 4 leading automobile companies in India like Maruti Suzuki Ltd, TATA Motors, Hyundai Motor, and Mahindra &Mahindra.

Sources of Data: The study is done from secondary data. The data is gathered from money control .com and company website.

Period of Study: The study is conducted for the period March 2021- March 2025.

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Research Framework Proposal

Table -1

	Descriptions	
Decision Criterion	Investment Valuation Ratios	• Net Profit Margin (NPM) • Return on Capital (ROC) • Return on Net Worth (RONW)
	Liquidity and Solvency Ratios	• Current Ratio (CR) • Quick Ratio (QR) • Financial Change Coverage Ratios (FCC)
	Management Efficiency Ratios	• Investment Turnover Ratio (ITR) • Total Asset Turnover Ratio (TATR)
	Profit & Loss Account Ratio	• Selling Distribution Cost Composition (SDC) • Expenses as Composition of total Sales (ETC)

The research's framework proposal, which comprises goals, criteria for making decisions, and alternatives for making decisions, is shown in **Table 1**. As decision criteria, ten sets of well-known financial ratios are set. The four categories of financial ratios are profitability, solvency, liquidity, and efficiency ((Acosta-González et al., n.d.). The ability of the business to fulfil its short-term obligations is indicated by a liquidity ratio, which makes it significant. It can quickly turn its current assets into cash. The solvency ratio highlights a company's long-term viability by assessing its capacity to meet its long-term financial obligations. In actuality, profitability ratios—which show how much value a company creates—are the basis for speculation by investors and shareholders. Common financial ratios, by R. Messer. (Page 325 of Emerald Publishing Limited's Financial Modelling for Decision Making: Using MS-Excel in Accounting and Finance, Bingley, UK, 2020.) All four types of financial ratios are employed in this study: CR, QR, and FCCR are primarily used to examine liquidity and solvency ratios; NPM, ROC, and RONW are used to examine profitability ratios; ITR and TATR are used to examine efficiency; and SDC and ETC are used to monitor a company's profit and loss.

Decision Alternatives

Maruti Suzuki, TATA Motors, Hyundai Motor, and Mahindra &Mahindra.

Proposed TOPSIS Model

Upon collection of various financial ratio data of five companies from moneycontrol.com,

Shannon’s entropy method is applied to calculate information’s about weight of decision criteria.

However, as the entropy value increases, the entropy weight decreases, indicating less information and lower significance of the criteria in a research study, and vice versa. Furthermore, Shannon’s entropy has garnered significant attention in TOPSIS studies. The entropy method serves as a standard approach for determining attribute weights based on the variability of data among alternatives ((Chai et al., 2019)). The concept entropy originated with Rudolp Clausius in 1865 as a response to the observation that a portion of functional energy produced by combustion processes is inevitably lost through dissipation, failing to be converted into useful work. In this method m indicators and n samples are set in the evaluation and measured value of ith indicator in jth value is recorded as x_{ij} . The Shannon Entropy Weight Method (EWM) is a technique used to determine the weight of the criterion in decision making assigning greater weights to the criterion with greater variability

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or importance. Entropy concept can be considered as a criterion for the degree of uncertainty represented by a discrete probability distribution The first step is standardization of the values. Let the standardized value of ith index in the jth sample is denoted by p_{ij} and calculation method is as follows:

Step-1: $p_{ij} = \frac{xij}{\sum_{j=1}^{n} xij}$

In the Step -2 Computation of the entropy measure of the project outcome using the equation

$E_j = -k \sum_{i=1}^{m} p_{ij} \ln p_{ij}$ in which K= 1/ln(m)

Step-3: The objective weight based on the entropy concept is

$W_j = \frac{1-E_j}{\sum_{j=1}^{n}(1-E_j)}$

In original situation $p_{ij} \ln p_{ij} = 0$ is set when $p_{ij} = 0$ for convenience in calculation.

Table 2:

Key Financial Ratios	Net profit Margin	Return on capital	Return on Net Worth	Current Ratio	Quick ratio	Financial charges coverage ratio	Investment Turnover Ratio	Total Assets Turnover ratio	Selling Distribution Cost composition	Expenses as composition of Total Sales
Maruti Suzuki India	9.18	20.6	15.72	0.81	0.65	116.7	1.91	1.93	0.73	6.52
Honda India Power	10.06	18.11	11.54	5.07	4.35	319.11	1.73	1.73	0.24	37.95
Tata Motors	10.61	20.92	26.21	0.51	0.59	9.63	1.67	1.76	0.45	4.19
Mahindra &Mahindra	10.85	25.35	20.01	1.14	0.92	122.94	1.89	1.97	0.57	3.92

Sources: Moneycontrol.com

Table 3 below shows the benefit criterion and negative criteria of the financial parameters.

Table -3

MAX	MAX	MAX	MAX	MAX	MAX	MAX	MAX	MIN	MIN
NPM	ROC	RONW	CR	QR	FCC	ITR	TATR	SDC	ETC

Table -4 depict the standardization of the values. Normalization enables more accurate and better decision making .The standardized value of ith index in the jth sample is denoted by p_{ij}

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Table -4 Normalization Matrix (p_{ij})

0.22555 2826	0.24240 9979	0.21393 5765	0.10756 9721	0.09984 639	0.20532 0384	0.26527 7778	0.26116 3735	0.36683 4171	0.12400 1521
0.24717 4447	0.21310 8967	0.15704 9537	0.67330 6773	0.66820 2765	0.56143 7771	0.24027 7778	0.23410 0135	0.12060 3015	0.72175 7322
0.26068 7961	0.24617 5571	0.35669 57	0.06772 9084	0.09062 98	0.01694 289	0.23194 4444	0.23815 9675	0.22613 0653	0.07968 8094
0.26658 4767	0.29830 5484	0.27231 8998	0.15139 4422	0.14132 1045	0.21629 8955	0.2625	0.26657 6455	0.28643 2161	0.07455 3062

***Authors calculations**

Entropy quantifies the uncertainty or randomness in a system. In the context of the Shannon method for normalization, entropy helps to determine the relative importance of each criterion.

Table: 5 Computation of Entropy measure

-0.3359	-0.3435	-0.3299	-0.2398	-0.2301	-0.3251	-0.3520	-0.3506	-0.3679	-0.2588
-0.3455	-0.3295	-0.2907	-0.2663	-0.2694	-0.3241	-0.3426	-0.3399	-0.2551	-0.2353
-0.3505	-0.3451	-0.3677	-0.1823	-0.2176	-0.0691	-0.3389	-0.3417	-0.3362	-0.2016
-0.3524	-0.3608	-0.3542	-0.2858	-0.2765	-0.3312	-0.3511	-0.3524	-0.3581	-0.1936

sum	-1.384	-1.379	-1.343	-0.974	-0.994	-1.049	-1.385	-1.385	-1.317	-0.889
Ej	0.6012	0.5988	0.5831	0.4231	0.4315	0.4558	0.6014	0.6014	0.5721	0.3862
1-Eij	0.3988	0.4012	0.4169	0.5769	0.5685	0.5442	0.3986	0.3986	0.4279	0.6138

***Author's Calculations**

The degree of importance of each criterion is indicated by its weights, A higher weight indicates greater importance and more significant impact on decision making. Weights of various criterion are shown below. Shannon weight calculation technique is used in the study.

Table -6 (Weights Calculated)

wij	0.0840	0.0845	0.0879	0.1216	0.1198	0.1147	0.0840	0.0840	0.0902	0.1293

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Table-7 Rank Analysis

	RANK				
Name of Companies	**Mar-25**	**Mar-24**	**Mar-23**	**Mar-22**	**Mar-21**
MARUTI SUZUKI	**2**	**1**	**1**	**2**	**3**
HYUNDAI MOTOR	**4**	**4**	**4**	**4**	**4**
TATA MOTORS	**1**	**2**	**2**	**1**	**1**
MAHINDRA &MAHINDRA	**3**	**3**	**3**	**3**	**2**

*Calculated using TOPSIS Model by using R Programming.

***Authors calculations**

Result and Implications: It is visible from the above table (Table No. 7) that TATA Motors is more consistent in maintaining its highest position for the years 2022 and 2021 and 2025 and there is a consistency in maintenance of the financial performance of Manindra &Mahindra along with Hyundai Motors.

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