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An Analytical Study Of Sales Growth In Electric Vehicle Sector Of India

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Abstract: An electric vehicle (EV) is a transportation mode which is driven by one or multiple electric motors. Recently, there has been a rise in both public budget allocations and corporate investments in electric vehicles (EVs) with the aim of attaining a specific goal. Governments worldwide are implementing policies to encourage the adoption of electric vehicles, including financial incentives, regulatory measures, and investments in charging infrastructure. These initiatives aim to address environmental challenges, reduce dependence on traditional fossil fuels, and promote a sustainable and eco-friendly mode of transportation. This study examines the prevalence of e-vehicles over the past five years and forecasts estimated sales for future years, providing valuable insights to companies as they chart their course ahead.

A significant upward trajectory has been observed in the sales of 2-wheeler electric vehicles over the past five years. While sales were relatively modest in the 2018-19 period, there were substantial increases noted in 2022 and 2023. Conversely, a decline in the trend was observed for 3-wheeler e-vehicles during the years 2019-20 and 2020-21. However, an increasing trend in sales was noticed in 2021-22 and 2022-23 for 3-wheeler e-vehicles. The sales of 4-wheeler e-vehicles have shown a consistent increase over time. Notably, the growth rate of 2-wheeler and 4-wheeler e-vehicles during the study period exhibited significant increases.

Index Terms **- Electric vehicle, Sales, Trend, Forecast**

I. INTRODUCTION

An electric vehicle (EV) is a transportation mode driven by one or multiple electric motors for its movement. The power source for an EV may come from an external collector system drawing electricity from outside sources, or it can operate independently with a self-contained battery. Electric road vehicles consists of various transportation options, which includes electric passenger cars, electric buses, and electric trucks. The origins of early electric vehicles can be traced back to the late 19th century, coinciding with the advent of electrification during the Second Industrial Revolution. At that time, electricity emerged as a favored means for propelling motor vehicles due to its ability to offer a quieter, more comfortable, and easier operation compared to the gasoline engine cars of that era. However, despite these advantages, the limited energy storage capacity of contemporary battery technologies led to range anxiety, preventing widespread adoption of private electric vehicles throughout the 20th century.

Recently, there has been a rise in both public budget allocations and corporate investments in electric vehicles (EVs) with the aim of attaining a specific goal. Governments at both central and state levels have granted financial incentives for EVs, charging infrastructure, and manufacturing.

In June 2014, the Government of India introduced the Deen Dayal scheme, aiming to facilitate the financing and acquisition of battery-powered rickshaws across the country. Subsequently, in March 2015, the Motor Vehicles (Amendment) Bill was approved, officially recognizing battery-powered e-rickshaws as a valid mode of commercial transport.

In a pioneering move, Tripura became the first state in India to regulate the operations of e-rickshaws in January 2014. They formulated the Tripura Battery Operated Rickshaw Rules 2014, which include guidelines on various aspects such as driver age limits, license fees, renewal fees, road tax, provisions for vehicle fitness certificates, insurance for e-rickshaws, and the identification of designated routes for their operation.

The Department of Heavy Industry has been overseeing the implementation of the "Faster Adoption and Manufacturing of Electric and Hybrid Vehicles in India" scheme, commonly referred to as the FAME India scheme, since April 1, 2015.

In its initial phase, FAME I provides subsidies to 11 cities for the introduction of electric buses, taxis, and three-wheelers. These cities comprise Delhi, Ahmedabad, Bangalore, Jaipur, Mumbai, Lucknow, Hyderabad, Indore, and Kolkata. Additionally, two cities, Jammu and Guwahati, fall under a special category for the scheme.

The National Electric Mobility Mission Plan (NEMMP) 2020 outlines various objectives for the widespread adoption of electric vehicles in the country:

Benefits of using Electric vehicle (EV):

- Reduced Operational Expenses
- Minimal Maintenance Expenses
- Environmental Impact of Petrol and Diesel Usage
- Tax and Financial Advantages
- Ease of Operation and Quiet Operation
- Absence of Noise Pollution
- Home Charging Convenience

II Review of literature:

- Uthaya Kumar.V (2022) conducted research on the adoption of electric vehicles in India. The study aimed to understand customer preferences, satisfaction levels, and the transition from conventional vehicles to electric ones. It was found that a majority of respondents strongly agreed that electric vehicles are environmentally friendly and expressed a desire to purchase one within the next two years. Additionally, most respondents indicated a preference for electric cars.
- Mohammed, M. et al. (2018) conducted a study on electric vehicles in India, exploring the various types available in the market and discussing their benefits. They also addressed the opportunities and challenges within the electric vehicle industry, emphasizing the goal of reducing greenhouse gas emissions and cutting oil expenses by implementing EVs. The government's vision for 2030 in this regard was deemed ambitious, and the researchers suggested utilizing available opportunities while effectively addressing challenges.
- Panday, M. et al. (2014) focused on consumer perception regarding the purchase intention of electric cars in India. They examined perceived benefits and risks associated with electric car ownership, highlighting factors like perceived monetary and environmental benefits and costs. The study found that perceived monetary benefits positively influenced the decision to purchase electric cars, while perceived environmental benefits and perceived risks did not significantly impact purchase intention. Personal innovativeness was identified as a factor influencing the purchase decision.
- Parab, S. (2022) conducted a study on electric vehicles in India, noting that incentives play a crucial role in encouraging people to opt for EVs due to their lower operating costs compared to conventional

vehicles. The study highlighted the importance of government policies and incentives for early adopters. It also emphasized the need for increased awareness and familiarity with EVs to drive adoption. Suggestions included clearer government policies, incentives, campaigns, and celebrity endorsements to promote EV adoption.

III Problem statement:

In contemporary times, in response to environmental concerns, pollution control efforts, and the promotion of sustainable development, companies are increasingly manufacturing eco-friendly products. This trend extends to the automobile industry, where electric battery-powered vehicles have emerged. The current study focuses on the e-vehicle trend over the past five years, aiming to analyze sales patterns. Additionally, the study includes forecasts for future sales, aiding companies in devising their future strategies and roadmaps.

IV Objective of the study:

1. To undertake study on the sale of electronic vehicle in India
2. To analyse the sales trend in different types of electronic vehicle in India
3. To predict the future sale in electronic vehicle sector of India

V SCOPE OF THE STUDY:

1. The study covers the data of last 5 financial years starting from 2018-19 to 2022-23.
2. The data relating to the number of 2-wheeler electric vehicle, 3-wheeler electric vehicle and 4-wheeler electric vehicle for the last five years has been taken into consideration.

VI Research Methodology:

Meticulously acquires secondary data sourced from a myriad of digital platforms, including websites, scholarly articles, and internet repositories. This wealth of information manifests in various forms, encapsulating the annual growth of sales through percentages, as well as in the form of visually compelling charts and graphs.

Rooted in the timeframe spanning 2018-19 to 2022-23, this study intricately examines the sales figures of electronic vehicles, drawing insights that illuminate the evolving trends. Moreover, it dares to traverse the temporal divide, venturing into the uncharted realms of 2024-25 to 2027-28, offering glimpses into the anticipated future of electronic vehicle sales in India.

This comprehensive exploration encompasses the entirety of the electronic vehicle market, encompassing the sales dynamics of two-wheelers, three-wheelers, and four-wheelers alike, thus enriching the narrative with a panoramic view of automotive innovation.

Descriptive statistics were employed for data analysis. CAGR representing the Compounded Average Growth Rate over the specified time frame. CAGR was utilized to assess the growth in e-vehicle sales over a five-year period (from 2018-19 to 2022-23). A higher CAGR indicates a greater growth.

Additionally, the Mann-Kendall test was employed to determine if statistically significant trends existed in e-vehicle sales over time. The Mann-Kendall test was used to test the following hypotheses:

H_{01}: No significant trend is observed in the sale of 2-wheeler e-vehicle.

H_{02}: No significant trend is observed in the sale of 3-wheeler e-vehicle.

H_{03}: No significant trend is observed in the sale of 4-wheeler e-vehicle.

In this study, the projection of e-vehicle sales for the financial years 2024-25 to 2027-28 was carried out using SPSS. Forecasting methodologies such as expert modeling and ARIMA models were employed to predict the future trends of the number of e-vehicles sold.

VII Result and Discussion

Table 1: Table showing number of Two-wheeler e-vehicle sold

Years					
Month	FY18-19	FY19-20	FY20-21	FY21-22	FY22-23
Apr	486	3079	85	5636	52389
May	681	1668	558	1315	41727
June	955	1758	1511	4751	44054
July	1281	1568	1488	14692	46584
Aug	1570	1507	2115	16099	53129
Sept	2258	1558	3089	17959	55124
Oct	2560	2136	2953	20704	78236
Nov	3311	3147	4188	24503	77376
Dec	3171	2235	4948	26862	65106
Jan	2745	2942	5319	30041	62891
Feb	3121	2353	6579	35759	66091
Mar	5868	2883	11970	54320	85347
Total	28007	26834	44803	252641	728054

[Source: https://www.smev.in/]

Table 2: Descriptive statistics of Two wheeler e-vehicle sold

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
FY 18-19	12	486	5868	2333.92	1499.426
FY 19-20	12	1507	3147	2236.17	637.450
FY 20-21	12	85	11970	3733.58	3263.481
FY 21-22	12	1315	54320	21053.42	14823.561
FY 22-23	12	41727	85347	60671.17	14270.603

Chart 1: Chart showing number of Two-wheeler e-vehicle sold

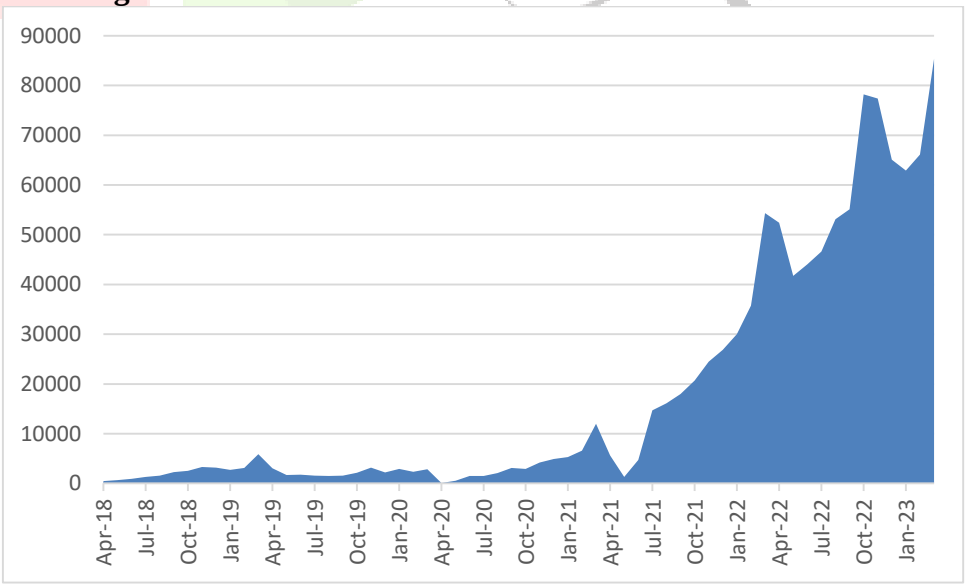
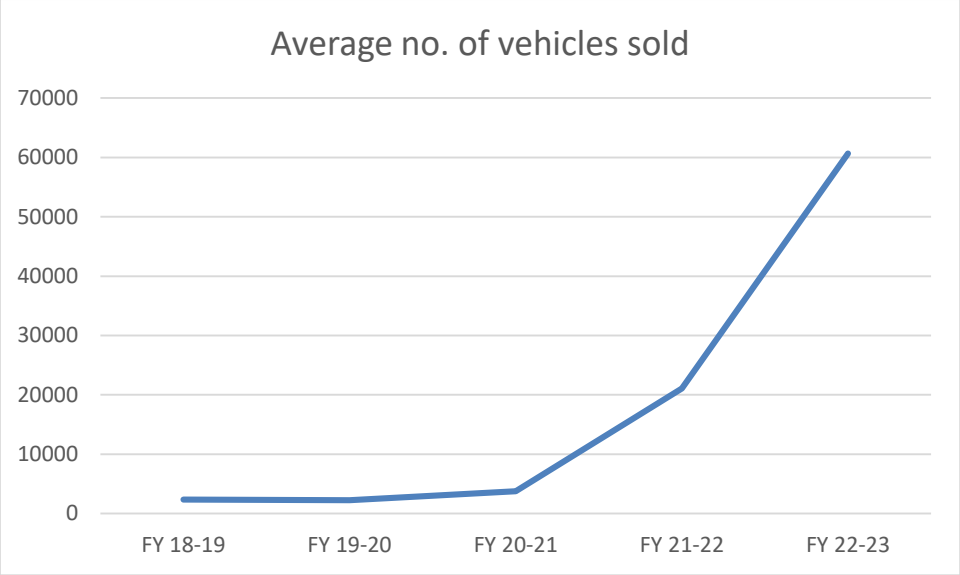


Chart 2: Chart showing yearwise mean number of Two-wheeler e-vehicle sold



Significant growth has been noted in the sales of 2-wheeler electric vehicles over a span of five years based on the provided data. Sales were relatively low in the 2018-19 period, but substantial increases were observed in 2022 and 2023.

Specifically, the average number of 2-wheeler E-vehicles sold increased from 2334 in 2018-19 to 21,053 in 2021-22 and further to 60,671 in 2022-23. In 2018-19, the highest sales occurred in March, while the lowest were recorded in April. However, for the financial years 2020-21, 2021-22, and 2022-23, the peak sales were consistently reported in March. The highest sales for the fiscal year 2019-20 were observed in November. Conversely, for the financial years 2021-22 and 2022-23, the lowest sales were recorded in May.

This pattern suggests that sales tend to be lower in the first half of the financial year but increase significantly towards the second half.

Table 3: Table showing number of Three-wheeler e-vehicle sold

Years					
Month	FY18-19	FY19-20	FY20-21	FY21-22	FY22-23
Apr	6593	7888	870	7951	21626
May	7276	8256	668	1048	24100
June	7556	9187	4662	6338	27846
July	9844	10746	5871	1853	30489
Aug	9990	11527	5937	13309	33055
Sept	11130	14340	7747	16964	37404
Oct	12305	13261	7946	18497	35889
Nov	10517	15543	8537	18690	40403
Dec	12501	14422	10242	24118	35542
Jan	10533	13553	10931	19548	34308
Feb	8786	13622	12550	19621	35995
Mar	9000	10706	14937	24606	45225
Total	116031	143051	90898	172543	401882

[Source: https://www.smev.in/]

Table 4: Descriptive statistics of Three wheeler e-vehicle sold

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
FY 18-19	12	6593.00	12501.00	9669.2500	1896.95330
FY 19-20	12	7888.00	15543.00	11920.9167	2571.91169
FY 20-21	12	668.00	14937.00	7574.8333	4318.60526
FY 21-22	12	1048.00	24606.00	14378.5833	8188.68202
FY 22-23	12	21626.00	45225.00	33490.1667	6658.59528

Chart 3: Chart showing number of Three-wheeler e-vehicle sold

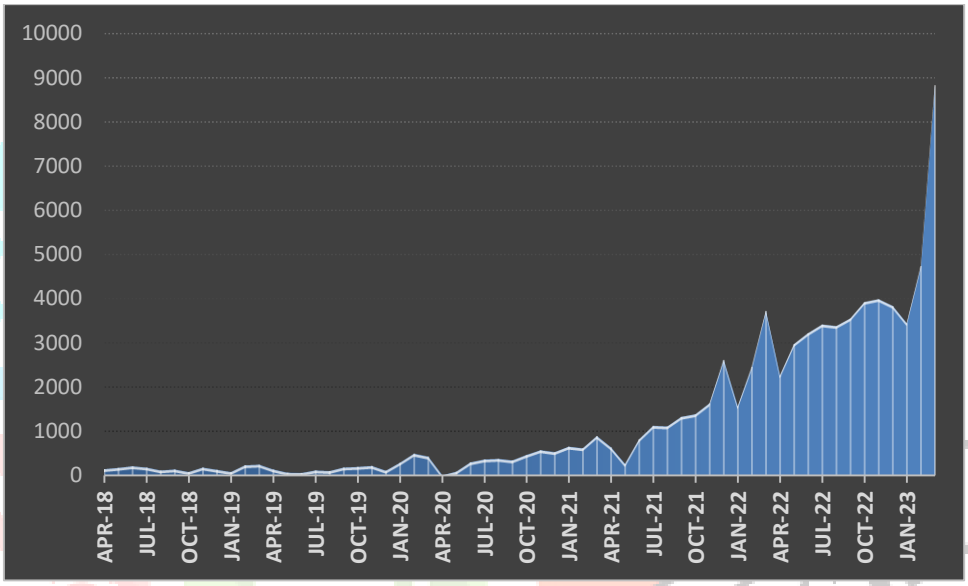
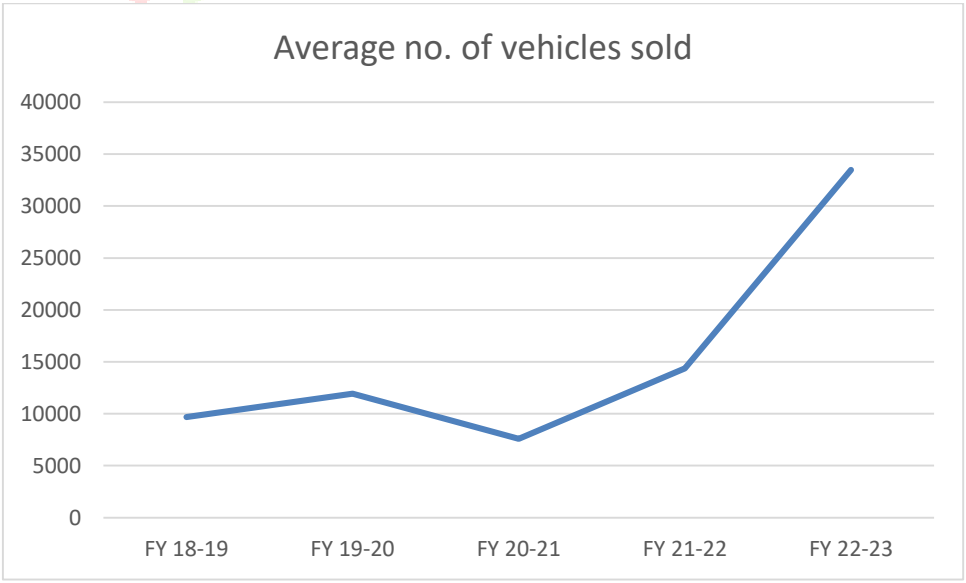


Chart 4: Chart showing yearwise mean number of 3-wheeler e-vehicle sold



From the above data, a decline in the trend has been observed during the year 2019-20 and 2020-21. However in the year 2021-22 and 2022-23 an increasing trend in the sales of 3-wheeler e-vehicle has been noticed. The average number of 3-wheeler E-vehicle sold in the year 2020-21 is 7575 which rose to 14,379 in the year 2021-22 and 33,490 in the year 2022-23. In the year 2018-19 the maximum sale is observed in the month of December while the minimum sale is observed in the April month. For the financial year 2019-20 the maximum sale is observed in the month of November. For the financial year 2020-21, 2021-22 and 2022-23 the maximum sale is reported in the month of March. For the financial year 2018-19, 2019-20 and 2022-23 the minimum sales has been reported in the month of April. For the financial year 2020-21 and 2021-22. It can be noted that the sales are low in the beginning half of the financial year while they are at higher level towards the second half of the year.

Table 5: Table showing number of Four-wheeler e-vehicle sold

Years					
Month	FY18-19	FY19-20	FY20-21	FY21-22	FY22-23
Apr	146	139	3	634	2255
May	175	65	84	257	2967
June	210	57	296	817	3214
July	179	111	357	1119	3410
Aug	116	100	371	1105	3371
Sept	139	180	338	1322	3548
Oct	75	194	462	1383	3916
Nov	176	218	567	1629	3981
Dec	126	105	525	2617	3832
Jan	74	290	650	1563	3439
Feb	228	493	615	2452	4738
Mar	241	425	886	3724	8828
Total	1885	2377	5154	18622	47499

[Source: https://www.smev.in/]

Table 6: Descriptive statistics of Four wheeler e-vehicle sold

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
FY 18-19	12	74.00	241.00	157.0833	54.58514
FY 19-20	12	57.00	493.00	198.0833	139.68501
FY 20-21	12	3.00	886.00	429.5000	244.32672
FY 21-22	12	257.00	3724.00	1551.8333	962.78911
FY 22-23	12	2255.00	8828.00	3958.2500	1647.63269

Chart 5: Chart showing number of Four wheeler e-vehicle sold

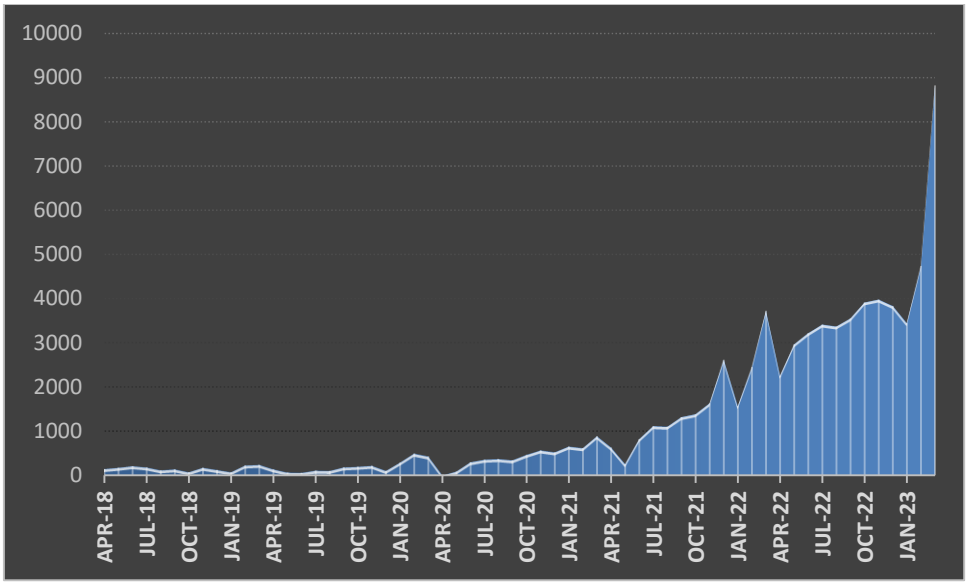
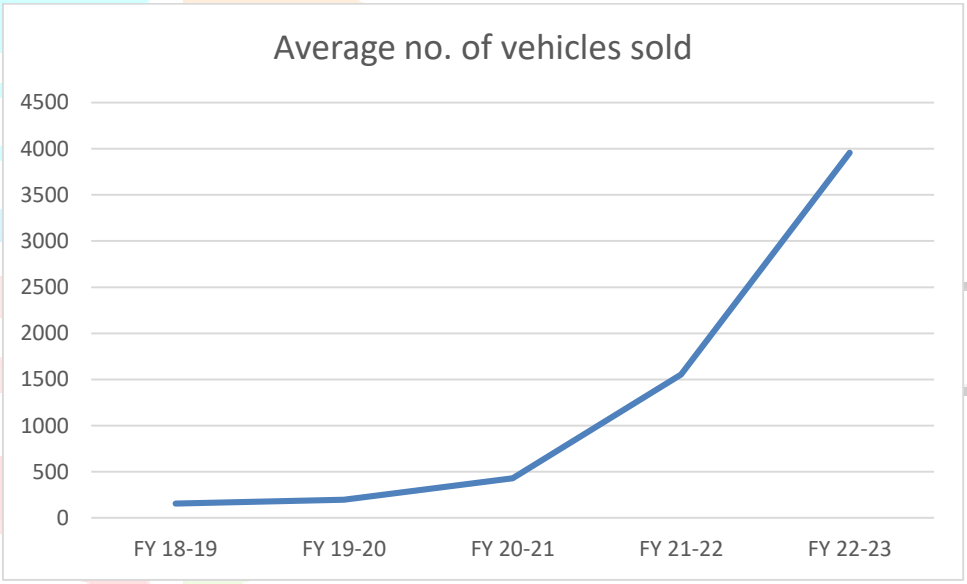


Chart 6: Chart showing year wise mean number of 4-wheeler e-vehicle sold



The data indicates a notable upward trend over the specified time frame. In the year 2018-19, the average number of 4-wheeler E-vehicles sold was 157, which increased substantially to 1552 in 2021-22 and further to 3958 in 2022-23. Interestingly, for the years 2018-19, 2020-21, 2021-22, and 2022-23, the peak sales occurred in March, whereas in 2019-20, the highest sales were recorded in February. Conversely, the lowest sales for 2018-19 and 2019-20 were observed in January and June. For 2020-21 and 2022-23, the minimum sales were reported in April, and for 2021-22, they were in May.

Table 7: Table showing CAGR of different category of E-Vehicles

Type of vehicle	FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	CAGR
2-wheeler	2333.92	2236.17	3733.58	21053.42	60671.17	125.80%
3-wheeler	9669.25	11920.917	7574.8333	14378.583	33490.167	36.42%
4-wheeler	157.0833	198.0833	429.5	1551.8333	3958.25	124.05%

According to the above data, the Compound Annual Growth Rate (CAGR) for 2-wheeler vehicles is recorded at 125.80%, the highest among all categories. This suggests that the sales growth of 2-wheeler

vehicles surpasses that of both 4-wheeler and 3-wheeler e-vehicles. Notably, the CAGR for 4-wheeler vehicles is 124.05%, which closely aligns with the CAGR for 2-wheeler e-vehicles. Consequently, it can be inferred that there has been a significant increase in the growth rates of both 2-wheeler and 4-wheeler e-vehicles during the study period. Conversely, the CAGR for 3-wheeler vehicles stands at 36.42%, considerably lower compared to the CAGR for both 2-wheeler and 4-wheeler e-vehicles.

Mann Kendall Test:

Mann Kendall test has been performed to identify whether a significant trend observed in the sale of e-vehicles. The following hypothesis were tested using Mann Kendall Test.

H_{01}: No significant trend is observed in the sale of 2-wheeler e-vehicle.

H_{02}: No significant trend is observed in the sale of 3-wheeler e-vehicle.

H_{03}: No significant trend is observed in the sale of 4-wheeler e-vehicle.

Table: 8 Mann Kendall Test statistics:

Vehicle Type	P-value	Slope	Trend	H
2-wheeler	0.09	143957.63	no trend	False
3-wheeler	0.22	49241.38	no trend	False
4-wheeler	0.03	9763.00	increasing	True

For the 2-wheeler e-vehicle the p value is 0.09 which is greater than 0.05. It indicates that we fail to reject null hypothesis for the sale of 2-wheeler e-vehicle. Hence the trend observed in the sale of 2-wheeler e-vehicle is not statistically significant.

For the 3-wheeler e-vehicle the p value is 0.22 which is greater than 0.05. It indicates that we fail to reject null hypothesis for the sale of 3-wheeler e-vehicle. Hence the trend observed in the sale of 3-wheeler e-vehicle is not statistically significant.

For the 4-wheeler e-vehicle the p value is 0.03 which is less than 0.05. It indicates that we reject null hypothesis for the sale of 4-wheeler e-vehicle. Hence the trend observed in the sale of 4-wheeler e-vehicle is statistically significant.

Estimation of future sales:

Using various statistical Model the future sale for the period of 4 years starting from financial year 2023-24 to 2026-27 of 2-wheeler, 3-wheeler and 4 wheeler e-vehicle has been estimated.

Table 9: Model Fit 2-wheeler e-vehicle

Model Fit 2-wheeler e-vehicle											
Fit Statistic	Mean	SE	Minimum	Maximum	Percentile 5	10	25	50	75	90	95
Stationary R-squared	.144	.	.144	.144	.144	.144	.144	.144	.144	.144	.144
R-squared	.967	.	.967	.967	.967	.967	.967	.967	.967	.967	.967
RMSE	4492.398	.	4492.398	4492.398	4492.398	4492.398	4492.398	4492.398	4492.398	4492.398	4492.398
MAPE	138.011	.	138.011	138.011	138.011	138.011	138.011	138.011	138.011	138.011	138.011
MaxAPE	4007.112	.	4007.112	4007.112	4007.112	4007.112	4007.112	4007.112	4007.112	4007.112	4007.112
MAE	2974.739	.	2974.739	2974.739	2974.739	2974.739	2974.739	2974.739	2974.739	2974.739	2974.739

MaxAE	17782.125	.	17782.125	17782.125	17782.125	17782.125	17782.125	17782.125	17782.125	17782.125	17782.125
Normalized BIC	17.025	.	17.025	17.025	17.025	17.025	17.025	17.025	17.025	17.025	17.025

The following table 9 shows the model fit statistics for 2-wheeler e-vehicle. Which describe the different value of Stationary R-square, R-square, Root mean square Errors, mean absolute percentage error and so on related to 2-wheeler e-vehicle. Here the positive value of stationary R-squared indicated that the presented model is under consideration is a better than the baseline model. Also the value of R-squared is nearer to 1(0.967) which means that all the point related to this study are explained by the regression line.

Table 10: Table showing forecast sales of 2-wheeler e-vehicle

Years				
Month	FY24-25	FY25-26	FY26-27	FY27-28
Apr	79173	92964	106755	120546
May	76048	89839	103630	117421
June	77484	91275	105066	118857
July	80021	93812	107603	121394
Aug	81803	95594	109385	123175
Sept	82937	96727	110518	124309
Oct	88277	102068	115859	129649
Nov	89484	103275	117066	130857
Dec	87464	101255	115046	128836
Jan	87807	101598	115389	129180
Feb	89820	103611	117402	131193
Mar	99137	112928	126719	140510
Total	1019457	1184947	1350437	1515927

Table 10 indicating the forecasting of sale about 2-wheeler electronic vehicle from the year 2024-25 to 2027-28 and the figures shows the powerful prediction of number of sales in 2-wheeler electronic vehicle. The sale of 2-wheeler e-vehicle in 2024-25 is 10,19,457 which will go up to the 11,84,947 with rise of 16.23% in 2025-26. By the end of 2026-27 it will be at 13,50,437 with an increase of 32.47% and expected to reach at the peak of 15,15,927 with an increase of 48.70% in 2027-28.

Table 11: Model Fit 3-wheeler e-vehicle

Model Fit 3-wheeler e-vehicle											
Fit Statistic	Mean	SE	Minimum	Maximum	Percentile						
					5	10	25	50	75	90	95
Stationary R-squared	.557	.	.557	.557	.557	.557	.557	.557	.557	.557	.557
R-squared	.934	.	.934	.934	.934	.934	.934	.934	.934	.934	.934
RMSE	2798.065	.	2798.065	2798.065	2798.065	2798.065	2798.065	2798.065	2798.065	2798.065	2798.065
MAPE	36.645	.	36.645	36.645	36.645	36.645	36.645	36.645	36.645	36.645	36.645
MaxAPE	592.167	.	592.167	592.167	592.167	592.167	592.167	592.167	592.167	592.167	592.167
MAE	2065.283	.	2065.283	2065.283	2065.283	2065.283	2065.283	2065.283	2065.283	2065.283	2065.283
MaxAE	7480.697	.	7480.697	7480.697	7480.697	7480.697	7480.697	7480.697	7480.697	7480.697	7480.697

Normalized BIC	16.078	.	16.078	16.078	16.078	16.078	16.078	16.078	16.078	16.078	16.078

The following table 11 shows the model fit statistics for 3-wheeler e-vehicle. Which describe the different value of Stationary R-square, R-square, Root mean square Errors, mean absolute percentage error and so on related to 3-wheeler e-vehicle. Here the positive value of stationary R-squared indicated that the presented model is under consideration is a better than the baseline model. Also the value of R-squared is nearer to 1(0.934). It means that all the point related to this study are explained by the regression line.

Table 12: Table showing forecast sales of 3-wheeler e-vehicle

Years				
Month	FY24-25	FY25-26	FY26-27	FY27-28
Apr	36994	42006	47017	52029
May	36278	41290	46301	51313
June	39127	44138	49150	54161
July	39770	44781	49793	54804
Aug	42773	47784	52796	57807
Sept	45526	50538	55549	60561
Oct	45589	50600	55612	60624
Nov	46747	51759	56771	61782
Dec	47375	52386	57398	62409
Jan	45784	50796	55807	60819
Feb	46125	51136	56148	61159
Mar	48905	53916	58928	63939
Total	520992	581130	641269	701407

Table 12 indicating the forecasting of sale about 3-wheeler electronic vehicle from the year 2024-25 to 2027-28 and the figures shows the powerful prediction of number of sales in 3-wheeler electronic vehicle. The sale of 3-wheeler e-vehicle in 2024-25 is 5,20,992 which will go up to the 5,81,130 with rise of 11.54% in 2025-26. By the end of 2026-27 it will be at 6,41,269 with an increase of 23.09% and expected to reach at the peak of 7,01,407 with an increase of 34.63% in 2027-28.

Table 13: Model Fit for 4-wheeler e-vehicle

Model Fit for 4-wheeler e-vehicle											
Fit Statistic	Mean	SE	Minimum	Maximum	Percentile						
					5	10	25	50	75	90	95
Stationary R-squared	.469	.	.469	.469	.469	.469	.469	.469	.469	.469	.469
R-squared	.942	.	.942	.942	.942	.942	.942	.942	.942	.942	.942
RMSE	410.684	.	410.684	410.684	410.684	410.684	410.684	410.684	410.684	410.684	410.684
MAPE	103.137	.	103.137	103.137	103.137	103.137	103.137	103.137	103.137	103.137	103.137
MaxAPE	2854.166	.	2854.166	2854.166	2854.166	4.166	2854.166	2854.166	2854.166	2854.166	2854.166
MAE	260.308	.	260.308	260.308	260.308	260.308	260.308	260.308	260.308	260.308	260.308
MaxAE	1796.612	.	1796.612	1796.612	1796.612	1796.612	1796.612	1796.612	1796.612	1796.612	1796.612
Normalized BIC	12.240	.	12.240	12.240	12.240	12.240	12.240	12.240	12.240	12.240	12.240

The following table 13 shows the model fit statistics for 4-wheeler e-vehicle. Which describe the different value of Stationary R-square, R-square, Root mean square Errors, mean absolute percentage error and so on related to 4-wheeler e-vehicle. Here the positive value of stationary R-squared indicated that the presented model is under consideration is a better than the baseline model. Also the value of R-squared is nearer to 1(0.942) it means that all the point related to this study are explained by the regression line.

Table 14: Table showing forecast sales of 4-wheeler e-vehicle

Years				
Month	FY24-25	FY25-26	FY26-27	FY27-28
Apr	1036	1290	1544	1798
May	1617	2005	2394	2783
June	2076	2566	3056	3545
July	2545	3133	3722	4310
Aug	2809	3447	4084	4722
Sept	3315	4053	4792	5530
Oct	3904	4758	5612	6466
Nov	4362	5298	6235	7171
Dec	4749	5751	6753	7755
Jan	4183	5050	5918	6785
Feb	6124	7372	8620	9868
Mar	11001	13205	15410	17614
Total	47721	57930	68138	78347

Table 14 indicating the forecasting of sale about 4-wheeler electronic vehicle from the year 2024-25 to 2027-28 and the figures shows the powerful prediction of number of sales in 4-wheeler electronic vehicle. The sale of 4-wheeler e-vehicle in 2024-25 is 47,721 which will go up to the 57,930 with rise of 21.39% in 2025-26. By the end of 2026-27 it will be at 68,138 with an increase of 42.78% and expected to reach at the peak of 78,347 with an increase of 64.17% in 2027-28.

VIII Key findings of the study:

1. Significant growth has been noted in the sales of 2-wheeler electric vehicles over a span of five years based on the provided data. Sales were relatively low in the 2018-19 period, but substantial increases were observed in 2022 and 2023.
2. A decline in the trend has been observed during the year 2019-20 and 2020-21. However in the year 2021-22 and 2022- 23 an increasing trend in the sales of 3-wheeler e-vehicle has been noticed.
3. A notable upward trend is witnessed over the specified time frame in the sales of 4-wheeler e-vehicle.
4. According to the above data, the Compound Annual Growth Rate (CAGR) for 2-wheeler vehicles is recorded at 125.80%, the highest among all categories. The CAGR for 4-wheeler vehicles is 124.05%, which closely aligns with the CAGR for 2-wheeler e-vehicles.
5. From the Mann Kendall test, it is observed that the significant trend is observed in the sale of 4-wheeler e-vehicle.
6. Two-wheeler sales are projected to experience a robust growth rate of 16.23% in 2025-2026, followed by an even more substantial increase of 32.47% in 2026-27, and culminating in a noteworthy surge of 48.70% in 2027-28.
7. Three-wheeler sales are anticipated to see a steady rise with an 11.54% increase in 2025-2026, a further advancement of 23.09% in 2026-27, and a subsequent escalation of 34.63% in 2027-28.
8. Four-wheeler sales are forecasted to demonstrate significant growth, with a remarkable 21.39% surge in 2025-26, followed by a substantial uptick of 42.78% in 2026-27, and concluding with an impressive escalation of 64.17% in 2027-28.

IX Conclusion:

It is observed that over a period of time the market for the 2-wheeler and 4-wheeler electric vehicle has hugely expanded. There is a notable uptrend observed in the sales of various vehicle categories. The projected growth rates for two- wheeler, three-wheeler, and four-wheeler sales indicate promising opportunities and challenges for stakeholders in the electric automotive industry.

X Suggestions:

Based on the findings of this study, the following suggestions can be given.

1. Manufacturers and dealers should consider expanding their market reach to capitalize on the rising demand. This could involve penetrating new geographical regions, targeting niche segments, and exploring international markets where there is potential for growth.

2. To stay competitive in a rapidly evolving market landscape, companies should focus on continuous innovation and differentiation. Introducing new features, incorporating advanced technologies such as electric propulsion systems, and enhancing overall product quality can help attract discerning consumers and drive sales growth.
3. Collaborating with strategic partners, suppliers, and technology providers can enable companies to leverage synergies, access complementary resources, and accelerate innovation.
4. Building strong relationships with customers and delivering exceptional experiences throughout the entire purchasing journey is paramount for driving brand loyalty and repeat business.
5. Developing eco-friendly vehicles, implementing energy-efficient manufacturing processes, and adopting sustainable practices can not only align with regulatory requirements but also resonate with environmentally conscious consumers, thereby enhancing brand reputation and market positioning.

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