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**4TH INTERNATIONAL
MULTIDISCIPLINARY
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V-CMT**

**4th December,
2021**



**'TRANSFORMING
WITH CHANGING
DIMENSION IN
INDUSTRY AND
EDUCATION'**

V-CMT DEC 2021

ISBN:978-93-5578-200-7

E-Motorcycle: A solution to reduction in cost of transportation

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ABSTRACT

This research covers the area of electric vehicles stand for personal vehicle and its relevant market including the background information about the topic. The research is focusing on the research of current situation for the buyers and the less and more favourable conditions in Indian automobile industry. The principal of the report is comparative research of electric vehicle and conventional vehicles. In addition to this, the research focuses on the total cost of ownership of owning Electric vehicle instead of the conventional vehicle in the Indian market. In addition, the research assumptions are used in the formation of a questionnaire focusing on finding out about the awareness of electric vehicles among the publicity nowadays. The final statement that is going to be approved or rejected is the electric vehicles as a better alternative to the conventional vehicle in India.

Keyword: *Electronic motorcycle, Electronic Vehicle, plug-in, hybrid vehicles, conventional vehicles, Indian bike market*

1. INTRODUCTION

Energy crisis is one of the major concerns of today's world due to fast depleting resources of petrol, diesel, and natural gas. In combination with this, environmental decay is an additional factor which is contributing to the depletion of resources which is an alarming notification. Electric Bike which works on the battery that is powered by the motor is the general mode of transport for a local trip. The Electric bike which will be running on battery, the power is supplied by the motor, thereby supplying this power to drive the other gear components. The main purpose of using E-bike is that it is user-friendly, economical, and relatively cheap. The efficiency of this system is undeniable compared to conventional modes of transport.

2. REVIEW OF LITERATURE

A review of the relevant literature has been described as under.

Akshat Bansal & Akriti Agarwal (2018), in their research paper on "Comparison of Electric and Conventional Vehicles in Indian Market". the research focuses on the total cost of ownership of owning Electric vehicle instead of the conventional vehicle in the Indian market. The research also emphasizes on manufacturer perspective by finding out the best segment to launch an electric vehicle in India. In addition, the research assumptions are used in the formation of a questionnaire focusing on finding out about the awareness of electric vehicles among the publicity nowadays.

A. Jhunjhunwala, P. Kaur and S. Mutagekar in their research paper on "Electric Vehicles in India: A Novel Approach to Scale Electrification," in IEEE Electrification Magazine explained that over the last few years, electric vehicles (EVs) have captured the imagination of people in many parts of the world. Approximately 1.1 million passenger EVs (cars) were sold in 2017, up by about 57% from the previous years. Several nations have announced that their vehicles will be fully electric by 2025, 2030, or 2040. General Motors, Ford, Toyota, Volkswagen, and others demonstrated their EV ambitions by making major EV announcements.

Khurana A, Kumar VVR, Sidhpuria M in their research paper titled, “A Study on the Adoption of Electric Vehicles in India: The Mediating Role of Attitude” explained that various governments are encouraging people to switch to EVs by incentivizing the transition. Previous studies indicate that the high cost of the electric car, non-availability of charging infrastructure, time and range anxiety act as impediments to consumer adoption. The Government of India has given a call for ‘only Electric Vehicles’ on Road by 2030. This article is contemporary and examines the different factors that affect a consumer’s adoption of an EV.

3. RESEARCH METHODOLOGY

The present study is an analytical study because it deals with statistical data. The study is based on primary as well as secondary data. The primary data is collected via structured questionnaire from 141 respondents. The secondary data is collected mainly from the sources available on internet like the articles, journals and websites. Data is presented with the help of Graphs, charts and tables etc, whereas data analysis is done via excel and SPSS software. The statistical tools used are enumerated below:

1. Arithmetic mean for calculating values for the purpose of evaluation.
2. One-way ANOVA for analysis and interpretation.

OBJECTIVES

The following are the broad objectives of this research paper:

1. To find out the market share of different e-motorcycle manufacturing companies in India.
2. To find out the factors influencing the preference for e-motorcycles.
3. To perform comparison between e-motorcycles and petrol bikes.

HYPOTHESIS

H1 - Electric motorcycles are more suitable in current situation.

H0 - Electric motorcycles are not suitable in current situation.

H1 - Electric motorcycles are more convenient than petrol bikes.

H0 - Petrol bikes are more convenient than electric motorcycles.

MEANING OF E-MOTOR CYCLE

An electric motorcycle (e-motorcycle) is a motorized bike with an integrated electric motor used to assist propulsion. Electric motorcycles and scooters are plug-in electric vehicles with two or three wheels. The electricity is stored on board in a rechargeable battery, which drives one or more electric motors. Electric scooters (as distinct from motorcycles) have a step-through frame. Electric motorcycles usually have a larger battery pack and can go up to 100-110km on a single charge.

PROS AND CONS OF ELECTRIC BIKE

PROS:

(i) Zero Vehicular Pollution:

Of course, this is the No.1 reason for such a massive shift to electric vehicles (EVs). They run on electric motors, and not use fossil fuels, which means they don’t let out any pollutants. In effect, the increasing adoption of EVs is being promoted to negate the major role that internal combustion-engined (ICE) vehicles have played in the world’s overall carbon emissions.

(ii) No Maintenance:

Even after months of daily driving, all that an electric two-wheeler requires is regular cleaning and the occasional lubrication. They have very few moving parts and mechanicals compared to their conventional petrol-powered bikes and scooters. Also, they don't require engine oil or air filters which are the commonly replaced components on a ICE vehicle. Hence, only basic parts need maintenance.

(iii) No Noise:

Apart from polluting the air, conventional two-wheelers with petrol engines are quite noisy. A few actually enjoy this noise, but most would rather do away with it. With an electric two-wheeler, that is just what you can do, as the electric motor makes only a light hum even at full speed, reducing the overall noise pollution of your city.

(iv) Cost Efficient:

Electric two-wheelers usually come with two types of cost benefits - no maintenance over time and a more stable energy source price. Since electric bikes and scooters run on electricity, they're relatively more affordable. The price of electricity does not fluctuate as frequently as that of petrol and diesel. So, you will always pay relatively less to recharge and run your electric two-wheeler. In fact, some electric two-wheelers have a running cost of 1/10th of a ICE vehicle.



Related	Last	Previous	Unit	Reference
Gasoline Prices	1.39	1.41	USD/Liter	Nov/21

Source: <https://tradingeconomics.com/india/gasoline-prices>

(v) Government Incentives:

Various countries and governments across the world have developed frameworks and implemented laws to promote the ownership of electric two-wheelers. In India, the government provides FAME II incentives, which bring down the on-road price of an electric two-wheeler considerably.

CONS:

(i) Higher Initial Investment:

Since electric two-wheelers are not as widely manufactured as their conventional cousins, their cost is still quite high. This makes EVs inaccessible for a large population, as not everyone is willing or can afford to pay the high premium. The primary reason for the high cost of electric

two-wheelers is the lithium-ion batteries, which sometimes can be 50 per cent more than the cost of the vehicle itself.

(ii) Short Range:

With the current level of battery technology, the range of an electric two-wheeler is mostly lesser than that of its conventionally powered counterpart. This coupled with the limited charging infrastructure deters EV buyers.

(iii) Not so great on performance:

Most of the premium, modern electric two-wheelers have an unimpressive top speed for the price they command. Sure, the initial acceleration is high but electric motors usually lose their steam as the speeds climb. None of the reasonably priced modern electric two-wheelers sold in India is properly highway worthy so far. Even the high-speed electric scooters on sale have a top speed in the range of 60-80kmph and are priced over Rs 1 lakh.

(iv) Charging Infrastructure:

The lack of good charging infrastructure poses a problem, particularly in developing countries such as India. Once that is taken care of, it could essentially eliminate range or future anxieties that plague electric two-wheeler owners. While growth is expected in the next few years, finding a charging point right when you need it is not as easy as finding a fuel bunk yet.

(v) Charge times:

It takes just two minutes to refuel a bike or a scooter, but charging an electric vehicle can take a couple of hours at the bare minimum. Yes, there is the advantage of quick charging tech now, which can give your EV a full charge in just about an hour. However, don't expect to find these fast chargers everywhere just yet. Moreover, not all electric two-wheelers have fast-charging capability as it puts additional strain on the battery's life. That said, a few companies have adopted swappable battery technology, which is a novel way to minimise downtime while charging and also reduce range anxiety to a certain extent.

(vi) Limited Options:

This may be a temporary concern considering the influx of EVs expected from varied manufacturers over the next couple of years. Currently, however, you can count the available options on your fingertips. Thanks to the limitation in battery technology, the range remains limited too. This is one of the reasons why most manufacturers dabble in the scooter segment rather than the motorcycle space.

4. INDIAN ELECTRIC VEHICLE MARKETS OVERVIEW

The Indian Electric Vehicle Market was valued at USD 5 billion in 2020, and it is expected to reach USD 47 billion by 2026, registering a CAGR of above 44% during the forecast period (2021-2026). The Indian Electric Vehicle Market has been impacted by the outbreak of the COVID-19 pandemic due to supply chain disruptions and halt of manufacturing units due to continuous lockdowns and travel restrictions across the country. However, the electric vehicle

(EV) market is still in its nascent stage in India. It is expected to grow at a much faster rate during the forecast period due to various government initiatives and policies.



5. CURRENT E-BIKES AVAILABLE IN INDIAN MARKETS:

In table 1 and table 2 below, it shows that current e-bikes available in Indian market.

Table 1: Comparison of e-Bikes

Model	Revolt RV 400	Revolt RV 300	Ultraviolette F77	Ather 450	Ather 450X	Bajaj Chetak	TVS iQube Electric
Rated Power	3000 W	1500 W	NA	3300 W	3300 W	3800 W	NA
Max Power	NA	NA	33.5 bhp (25 kW)	5400 W	6000 W	4080 W	4400 W
Top Speed	45-85 kmph	25-65 kmph	147 kmph	80 kmph	80 kmph	78 kmph	78 kmph
Battery Capacity	3.24 kWh	2.7 kWh	4.2 kWh	2.7 kWh	2.9 kWh	3.0 kWh	4.5 kWh
Range	80-150 km	80-180 km	130-150 km	55-75 km	60-85 km	85-95 km	75 km
Charging Time	4.5 Hrs	4.2 Hrs	5 Hrs (1.5 Hrs Fast Charge)	5 Hrs (80% in 1 Hr Fast Charge)	5 Hrs (80% in 1 Hr Fast Charge)	5 Hrs	5 Hrs
Price (ex-showroom)	₹ 1,29,463	₹ 1,10,963	₹ 3,00,000	₹ 1,08,847	₹ 1,48,754	₹ 1,15,000	₹ 1,15,000

Source: <https://www.bikedekho.com/>

Table 2 Comparison of e-Bikes

Model	Okinawa iPraise	Hero Photon	Ampere Magnus Pro	Okinawa Ridge Plus	Ampere Zeal	Hero Optima ER	Okinawa Lite
Rated Power	1000 W	1000 W	1200 W	800 W	1200 W	600 W	250 W
Max Power	2500 W	1500 W	NA	1700 W	NA	1200 W	250 W
Top Speed	58 kmph	45 kmph	55 kmph	45 kmph	50-55 kmph	40 kmph	25 kmph
Battery Capacity	3.3 kWh	2.7 kWh	1.8 kWh	1.74 kWh	1.8 kWh	2.7 kWh	1.25 kWh
Range	160 km (Eco)	110 km (Eco)	75-80 km	84 km	85-90 km	110 km	60 km
Charging Time	4 Hrs	5 Hrs	5-6 Hrs	3 hours	5-6 Hrs	4-5 Hrs	4-5 Hrs
Price (ex-showroom)	₹ 1,23,000	₹ 84,990	₹ 73,990	₹ 73,417	₹ 68,799	₹ 74,990	₹ 63,990

Source: <https://www.bikedekho.com/>

In table 1 and table 2, it clearly indicates that more than 10 electric bikes are available in the Indian market in current situation. The highest price is Rs.3,00,000 quoted by Ultraviolette F77 and lowest price is Rs. 63,990 quoted by Okinawa Lite.

6. ANALYSIS OF DATA

COST-BENEFIT ANALYSIS OF E-BIKE AND PETROL BIKE (ASSUMPTION)

Let us assume Mr.A using ebike and Mr.B using petrol bike. The following table gives you better idea about the cost-benefit analysis between bike and petrol bike.

Table 3

Sr No	Particulars	e-bike	Petrol Bike
1	Buying Cost	Rs.60,000	Rs.70,000
2	Daily Running	50 km	50 km
3	Fuel efficiency/Mileage	100km per charge	40km per litre
4	Fuel/electricity cost	Rs. 14 per 1.5 units	Rs. 109 per litre
5	Maintenance	Rs. 20,000 per year	Rs. 7500 per year
6	Time period	3 years	3 years

After 3 years here is how much Mr. A and Mr. B will spend

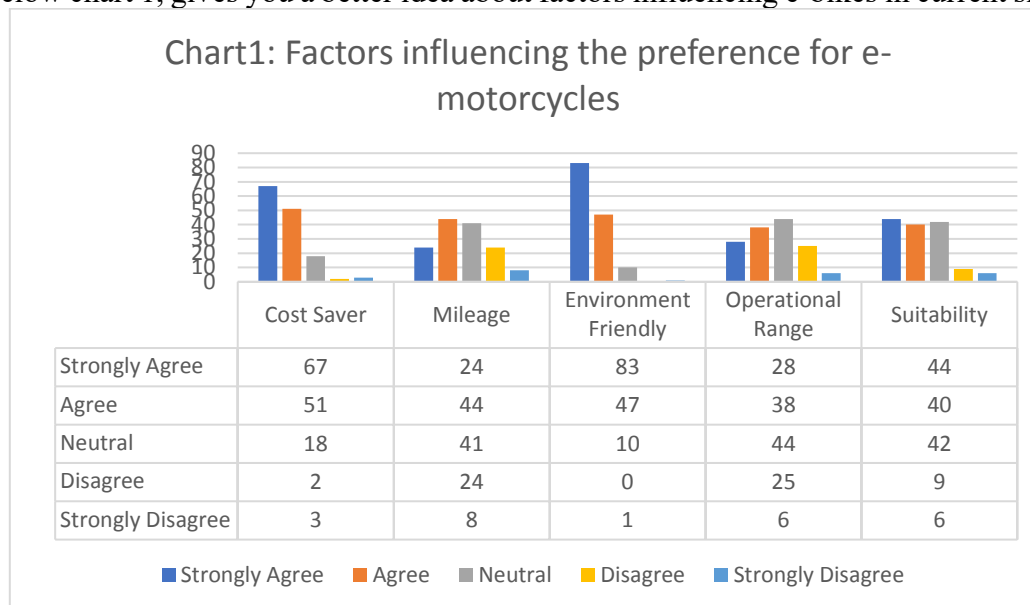
Table 4

Sr No	Particulars	e-bike	Petrol Bike
1	Total Petrol/electricity exp	Rs.7560	Rs.1,47,150

		$((50 \times 30 \times 36)/100) \times 14$	$((50 \times 30 \times 36)/40) \times 109$
2	Total Cost of maintenance	Rs.60,000	Rs.22,500
3	Gross exp including bike's cost	Rs.1,27,560	Rs.2,39,650

As per above analysis, over a period of 3 years, Mr. A will incur Rs. 1,27,560 on ebike, whereas Mr. B will incur Rs. 2,39,650 on his petrol bike. So the saving of Mr. A will be Rs. 1,12,090 for 3 years, so yearly savings of almost Rs.40,000.

Researcher collected primary data via structured questionnaire and 141 responses received. The below chart 1, gives you a better idea about factors influencing e-bikes in current situation.



Source: Author compilation

As per above chart1, 83.7% respondents agree that E-bikes are more cost saver as compared to petrol bikes. 92.2% respondents agree that E-bikes are more environmentally friendly as compared to petrol bikes. 60% respondents feel that E-bikes are more suitable to them as per the current situation.

The above data of respondents is analysed using IBM-SPSS software and One-way annova is applied as follows.

Table 5: Factors influencing the preference for e-bikes (Descriptive Statistics)

Users of E-Bikes	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Yes	114	10.3246	3.38789	.31730	9.6959	10.9532	5.00	21.00
No	27	12.3704	3.67055	.70640	10.9183	13.8224	6.00	25.00
Total	141	10.7163	3.52405	.29678	10.1296	11.3031	5.00	25.00

Source: Author Compilation as per IBM SPSS Software

As per Table 5, 114 respondents are using e-bikes out of 141. The mean of factors influencing the e-bikes of respondents is 10.3246. The standard deviation is 3.38789. Even though the people are not using e-bikes still they are agree that e-bikes are more suitable.

Table 6: Factors influencing the preference for e-bikes (Annova Test)

	Sum of Squares	df	Mean Square	F	Sig.	Table value
Between Groups	91.365	1	91.365	7.709	.006	7.71
Within Groups	1647.288	139	11.851			
Total	1738.652	140				

Source: Author Compilation as per IBM SPSS Software

As per Table 6, the one-way Annova test is applied to test the hypothesis. The annova result as given in table 6 shows that the calculated F value for hypothesis is 7.709 which is less than the Table value of 7.71. At 95% confidence level of significance is 0.05 and the F value is more than that i.e. 7.709. It is understood that electric vehicle is more suitable in the current situation. Therefore the null hypothesis i.e. Electric motorcycles are not suitable in current situation is rejected.

7. FINDINGS

1. The e-bikes are more cost saver as compared to petrol bikes.
2. E-bikes are more environmental-friendly which help to improve the air quality index of city like Mumbai.
3. Currently there are less availability of service station which is the main factor why people are reluctant to switch to e-bikes from petrol bikes. Still e-bikes have growth potential in the future.
4. The operational range of e-bikes is limited to short distance, however with new techniques, and development in e-bikes, the operational range will improve in the future.
5. Still there is a dilemma in the minds of petrol bike users to switch to e-bikes because of after sales services and charging related issues.

8. CONCLUSION

EVs are said to boost post-pandemic for economic recovery. The main aim of EVs in the country is to reduce the oil import and encourage green industrial policy. Electric vehicles will reduce the air pollution and mitigate climatic change. In order to promote usage of e-vehicles, the Indian government also provide lot of subsidies and schemes such as Faster Adoption and Manufacturing of Hybrid and Electric Vehicle (FAME scheme II). A lot of incentives are provided to the buyer such as basic subsidy, rebate, Income tax benefits under section 80EEB etc. In addition to all these incentives, all the electric vehicles are free of registration and road tax costs too. In spite of all the efforts taken by the government, the adoption of e-bikes are relatively less. This is because of many reasons such as less availability of service stations, charging issues, after sales services, etc. Finally, in the near future, EVs will have a great future in Indian market.

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