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A STUDY ON THE FACTORS INFLUENCING ADOPTION OF ELECTRIC TWO-WHEELERS IN TIER-1 CITIES

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Abstract : This master thesis investigates the factors influencing the adoption of electric two-wheelers in tier-1 cities, focusing on economic benefits, infrastructure availability, technological advancements, and personal barriers. The study employs a primary data collection method, surveying 408 respondents to gather insights into their perceptions and attitudes towards electric two-wheelers. Statistical analyses, including T-test, Anova and regression analysis, are employed to examine the relationships between variables and determine the key factors driving adoption decisions.

INTRODUCTION

Electric two-wheelers (E2Ws) represent an innovative and environmentally friendly mode of urban transportation that has gained significant attention in recent years. These vehicles encompass a range of two-wheeled electrically powered options, including electric bicycles (e bikes), electric scooters (e-scooters), and electric motorcycles. As cities continue to grow, these issues intensify, adversely affecting the quality of life for urban residents. Transitioning from conventional gasoline-powered vehicles to electric two-wheelers represents a concrete step towards reducing emissions and promoting a cleaner urban environment.

The electric vehicle (EV) industry is a rapidly evolving sector focused on the development, manufacturing, and distribution of vehicles powered by electric motors, rather than traditional internal combustion engines. This transformative industry aims to reduce carbon emissions, dependence on fossil fuels, and mitigate environmental impact by promoting sustainable transportation alternatives. EVs encompass a range of vehicles, including electric cars, buses, trucks, and two-wheelers, each contributing to the global shift towards cleaner and greener mobility solutions.

The electric vehicle (EV) industry has undergone significant growth and transformation in recent years, driven by a combination of technological advancements, environmental concerns, and government incentives. This burgeoning sector has revolutionized transportation and is poised to play a pivotal role in shaping the future of mobility.

The transition towards sustainable transportation necessitates a significant shift in consumer preference towards electric vehicles (EVs). While tier 1 cities in many countries are witnessing an initial wave of EV adoption, understanding the key factors influencing this decision remains crucial for accelerating widespread acceptance. Existing research has explored various barriers and motivators, but often focuses on broad categories like cost, range anxiety, and infrastructure limitations. This research delves deeper by examining four underexplored factors with nuanced analyses: economic, technological, infrastructural, and personal barriers.

CHALLENGES AND THE ROAD AHEAD:

Despite its success, the industry faces challenges like:

1. **Infrastructure Development:** One of the primary challenges for EV two-wheelers in tier 1 cities is the lack of adequate charging infrastructure. The availability of charging stations, especially in densely populated urban areas, remains limited, hindering the widespread adoption of electric two-wheelers.
2. **Range Anxiety:** Range anxiety, or the fear of running out of battery charge before reaching the destination, is a significant concern for potential EV two-wheeler buyers. Manufacturers need to focus on improving battery technology and increasing the range of electric scooters and motorcycles to address this issue and instill confidence among consumers.
3. **Affordability:** Despite the long-term cost savings associated with electric two-wheelers, the upfront cost of purchasing an EV remains relatively high compared to traditional petrol-powered counterparts. Price-sensitive consumers in tier 1 cities may hesitate to invest in electric two-wheelers unless they are offered competitive pricing or attractive financing options.
4. **Consumer Awareness:** Many consumers in tier 1 cities still lack awareness about the benefits of electric two-wheelers, including lower operating costs, reduced environmental impact, and government incentives. Manufacturers and policymakers need to undertake comprehensive awareness campaigns to educate potential buyers and dispel myths surrounding electric vehicles.

5. **Regulatory Support:** While the Indian government has introduced various policies and incentives to promote electric mobility, there is a need for more comprehensive regulatory support to accelerate the adoption of EV two-wheelers. This includes measures such as tax incentives, subsidies, and mandates for fleet electrification to create a favorable ecosystem for electric vehicle manufacturers and consumers.

TOTAL SIZE/ANNUAL TURNOVER OF THE INDUSTRY

The EV industry has experienced significant growth in recent years, driven by advancements in technology, environmental regulations, and increasing consumer demand for eco-friendly transportation options. The global EV market size has been expanding rapidly, with annual turnover reaching billions of dollars. According to industry reports, the global electric vehicle market was valued at over $162 billion in 2020, and it is projected to exceed $802 billion by 2027, representing a compound annual growth rate (CAGR) of over 22% during the forecast period.

KEY PLAYERS IN EV INDUSTRY

1. **Tata Motors Limited:** Tata Motors is one of the leading automotive manufacturers in India and has been actively involved in the development and production of electric vehicles. The company offers electric passenger cars like the Tata Nexon EV and the Tata Tigor EV, catering to the growing demand for eco-friendly transportation solutions.
2. **Mahindra Electric Mobility Limited:** Mahindra Electric, a subsidiary of Mahindra & Mahindra, specializes in electric vehicle technology and manufacturing. The company produces electric cars such as the Mahindra eVerito and the Mahindra e2oPlus, along with electric three-wheelers, contributing to India's sustainable mobility goals.
3. **Hero Electric:** Hero Electric is a prominent player in the electric two-wheeler segment in India. The company manufactures a wide range of electric scooters and motorcycles, including models like the Hero Electric Optima, Photon, and Nyx. Hero Electric focuses on affordability and accessibility, targeting urban commuters seeking alternative modes of transport.
4. **Ather Energy:** Ather Energy is a Bangalore-based startup that has gained recognition for its innovative electric scooters. The company's flagship models, the Ather 450X and Ather 450 Plus, offer advanced features like touchscreen displays, fast charging capabilities, and smart connectivity features, catering to tech-savvy consumers in urban markets.
5. **Ola Electric:** Ola Electric, a subsidiary of Ola Cabs, is making significant strides in the electric mobility sector with its focus on electric two-wheelers and electric vehicle charging infrastructure. The company aims to launch electric scooters manufactured at its state-of-the-art facility in Tamil Nadu and is also investing in building a robust charging network across the country.

NEED OF THE STUDY.

The study on the adoption of electric two-wheelers addresses a pressing need for sustainable transportation solutions in the face of increasing environmental concerns and urban congestion. With growing emissions from conventional vehicles and limited resources, there is a critical need to transition towards cleaner and more efficient modes of transportation. Electric two-wheelers offer a promising alternative with their low emissions, cost-effectiveness, and suitability for urban commuting. However, understanding the factors influencing their adoption is crucial for manufacturers, policymakers, and stakeholders to develop effective strategies that encourage widespread adoption. By investigating economic, technological, infrastructural, and personal barriers to adoption, this study aims to provide insights that inform targeted interventions and policies to accelerate the adoption of electric two-wheelers, thereby promoting sustainable mobility and mitigating environmental impact.

3.1Population and Sample

The population of interest for this study comprises individuals residing in tier 1 cities, where urbanization and transportation challenges are prominent. Tier 1 cities typically represent major urban centers with high population densities and significant vehicular traffic. These cities often experience environmental pollution and congestion issues, making them crucial targets for sustainable transportation initiatives.

A stratified random sampling method was employed to select participants from the population. Stratification involved dividing the population into distinct strata based on demographic or geographical characteristics. In this case, the strata may include factors such as age, gender, income level, or geographical location within the tier 1 cities.

From each stratum, a random sample of participants was selected to ensure representation across diverse demographic groups and geographical areas within tier 1 cities. A total of 408 individuals were surveyed to gather data on their perceptions, preferences, and barriers related to the adoption of electric two-wheelers.

By employing stratified random sampling, the study aimed to capture a comprehensive understanding of the factors influencing electric two-wheeler adoption among diverse segments of the population residing in tier 1 cities. This approach ensures that the findings are representative and applicable to the broader population of urban residents facing similar transportation challenges.

3.2 Data and Sources of Data

For this study both primary and secondary data has been collected. The data collected for this study encompassed a range of variables related to the adoption of electric two-wheelers. These variables may include demographic information (such as age, gender, income level), perceptions and attitudes towards electric vehicles, factors influencing adoption decisions (such as economic considerations, technological preferences, infrastructural barriers), and personal barriers in promoting electric vehicle adoption.

3.3 Theoretical framework

Variables of the study contains dependent and independent variable. The model suggests that the four listed factors (economic, technological, infrastructural, personal barriers) highlight the importance of both individual characteristics and the broader environment in shaping electric two wheeler adoption decisions. This suggests a nuanced approach considering both personal preferences and external influences.

RESEARCH METHODOLOGY

The methodology section outline the plan and method that how the study is conducted. This includes Universe of the study, sample of the study,Data and Sources of Data, study's variables and analytical framework. The detailsare as follows;

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3.2 Research Gap

Through research paper it suggests that it has lack of comprehensive studies on key factors; Economical, Technological, Infrastructural and personal barriers. Exploring the long term impact of these factors on adopting decision. Also how gender and salary impact on the adopting decision. By understanding these dynamics, we seek to provide actionable insights for policymakers, urban planners, and industry stakeholders, contributing to the accelerated and sustainable adoption of electric two-wheelers in Tier 1 cities.

3.2 Data and Sources of Data

For this study secondary data has been collected. From the website of KSE the monthly stock prices for the sample firms are obtained from Jan 2010 to Dec 2014. And from the website of SBP the data for the macroeconomic variables are collected for the period of five years. The time series monthly data is collected on stock prices for sample firmsand relative macroeconomic variables for the period of 5 years. The data collection period is ranging from January 2010 to Dec 2014. Monthly prices of KSE - 100 Index is taken from yahoo finance.

Variables Found
Dependent variable:
E2W Adoption Decision
Independent variable:
Economical
Technological
Infrastructural
Personal Barrier

Research Objective

- To assess the level of adoption decision amongst males and females.
- To analyze the impact of Economic, Technological, Infrastructural and Personal barrier on adopting an electric two-wheeler.
- To access the level of adoption decision amongst various salary ranges.

Scope of the study:
1. Research Focus: Investigating the factors influencing the adoption of electric two-wheelers.
2. **Variables:** Exploring various factors such as economic benefits, environmental concerns, technological advancements, social influence, etc., and their impact on the adoption decision.
3. **Demographic Considerations:** Considering demographic variables such as age, gender, income, etc., to understand how they may interact with the adoption factors.
4. **Geographical Scope:** Focusing on a specific geographical area or multiple regions to analyze variations in adoption patterns based on location.
5. **Data Collection:** Utilizing surveys or interviews to collect data from potential electric two-wheeler users regarding their perceptions, preferences, and intentions.
6. **Analysis Methods:** Employing statistical techniques like factor analysis, regression analysis, etc., to analyze the relationship between identified factors and adoption intentions.

3.3 Theoretical framework

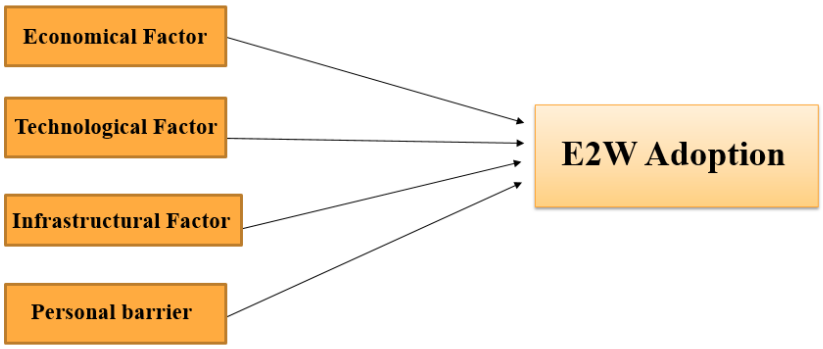

Figure 1

The model suggests that the four listed factors (economic, technological, infrastructural, personal barriers) highlight the importance of both individual characteristics and the broader environment in shaping electric two wheeler adoption decisions. This suggests a nuanced approach considering both personal preferences and external influences.

- **Economic factors:** Lower fuel costs and potential government incentives can make E2Ws more attractive, while their higher upfront cost can be a barrier.
- **Technological factors:** Range anxiety due to limited battery range and availability of charging stations can be a major hurdle. However, advancements in battery technology and charging infrastructure are addressing these concerns.
- **Infrastructural factors:** The lack of sufficient charging stations, especially public ones, and inadequate government policies supporting E2W infrastructure can hinder adoption.
- **Personal barriers:** Lack of awareness about E2W benefits, preference for gasoline vehicles due to habit, and risk aversion towards new technology can be personal barriers to adoption.

Descriptive Statistics – Normality Test

Statistics

		A1	A2	A3	A4	E1	E2	T1	T3	T4	T2	T5	S1	S2	WM1	WM2	WM3	SR1	SR2	SR3	SR4
N	Valid	490	490	490	490	490	490	490	490	490	490	490	490	490	490	490	490	490	490	490	490
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean		2.837	2.998	3.027	3.022	3.051	3.167	3.118	3.047	3.206	3.133	3.184	3.186	3.182	3.118	3.133	3.135	3.139	3.118	3.202	3.194
Median		2.910[a]	3.125[a]	3.159[a]	3.172[a]	3.205[a]	3.299[a]	3.246[a]	3.151[a]	3.328[a]	3.233[a]	3.300[a]	3.302[a]	3.302[a]	3.253[a]	3.279[a]	3.253[a]	3.263[a]	3.221[a]	3.318[a]	3.303[a]
Mode		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0	4.0	3.0	4.0	3.0	4.0	4.0	4.0	4.0	3.0[b]	3.0	4.0	3.0
Skewness		-.773	-.852	-.981	-1.113	-1.123	-1.270	-1.135	-.968	-1.189	-1.102	-1.219	-1.216	-1.203	-1.116	-1.115	-1.054	-1.096	-1.130	-1.164	-1.220
Std. Error of Skewness		.110	.110	.110	.110	.110	.110	.110	.110	.110	.110	.110	.110	.110	.110	.110	.110	.110	.110	.110	.110
Kurtosis		.575	.316	.734	1.069	1.019	1.680	1.266	1.027	1.368	1.575	1.670	1.612	1.528	1.079	.885	1.042	1.089	1.663	1.344	1.759
Std. Error of Kurtosis		.220	.220	.220	.220	.220	.220	.220	.220	.220	.220	.220	.220	.220	.220	.220	.220	.220	.220	.220	.220

Table 1

Descriptive statistics are a fundamental component of data analysis that provides a concise summary of the main characteristics of a dataset. These statistics help researchers and analysts understand the central tendencies, variability, and distribution of the data. Measures of central tendency, such as the mean, median, and mode, offer insights into the typical or average value of the data. Meanwhile, measures of variability, including the range, variance, and standard deviation, indicate the extent to which data points deviate from the central tendency. Additionally, descriptive statistics include measures of distribution, such as percentiles and quartiles, which highlight the spread of values across different portions of the dataset. By employing descriptive statistics, researchers can effectively summarize complex datasets, identify patterns or trends, and make informed decisions based on data-driven insights.

From the Descriptive Statistics we can clearly see that all the values of skewness is between -2 to +2 and kurtosis is between -7 to +7 this means the data collected or what we will be working with is normally distributed.

Frequency Tabulation- Adoption decision of an Electric two-wheeler based on Gender

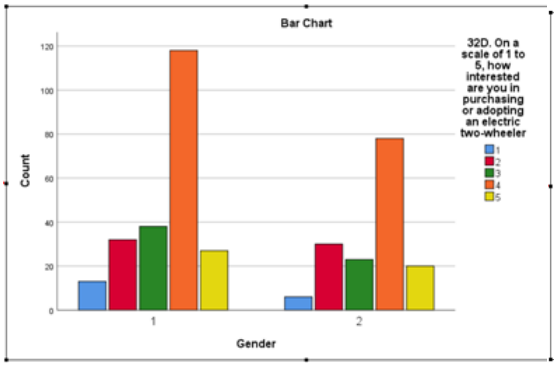

Figure 2

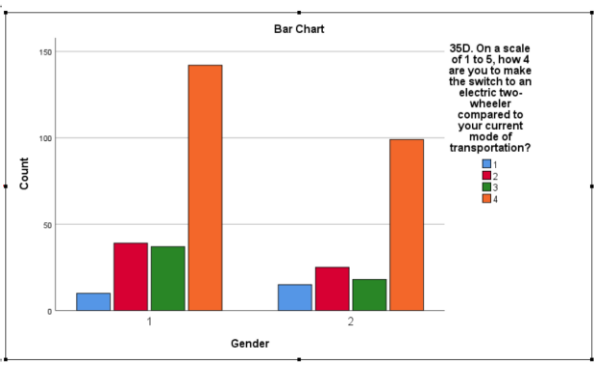

Figure 3

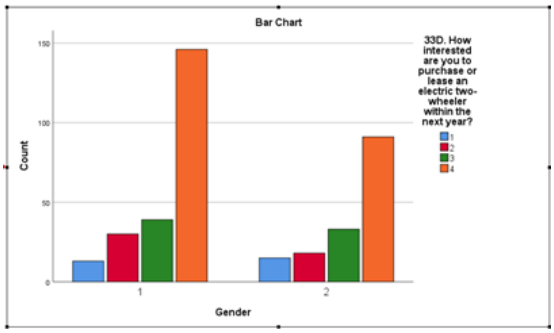

Figure 4

The observation that males show more interest in buying electric two-wheelers compared to females, and that females are less interested in switching from their current mode of transportation to electric two-wheelers, raises several potential interpretations and avenues for further analysis:

There may be inherent gender differences in preferences or priorities when it comes to transportation choices. Research in behavioral economics and sociology suggests that gender can influence decision-making processes, including purchasing decisions.

Another possibility is that the marketing and messaging surrounding electric two-wheelers may not effectively resonate with female consumers. Analyzing the marketing strategies and messaging used by electric two-wheeler manufacturers and considering whether they are inclusive and appealing to diverse demographic groups, including females.

Gender differences in access to infrastructure such as charging stations and parking facilities, as well as perceptions of safety and usability, could also play a role.

Adopting decision of Electric two-wheeler based on salary ranges

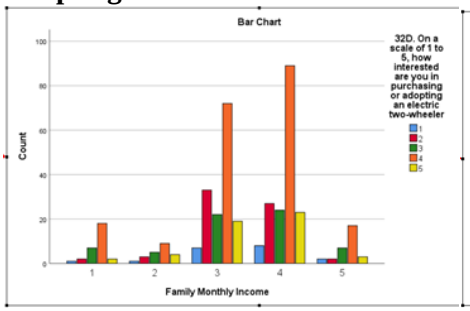

Figure 5

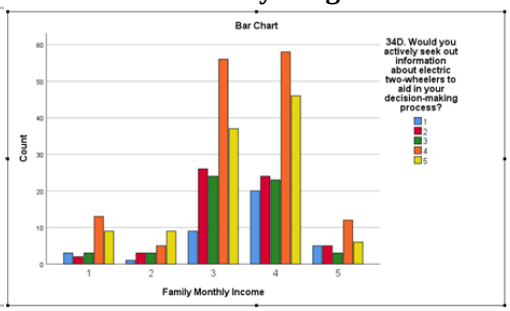

Figure 6

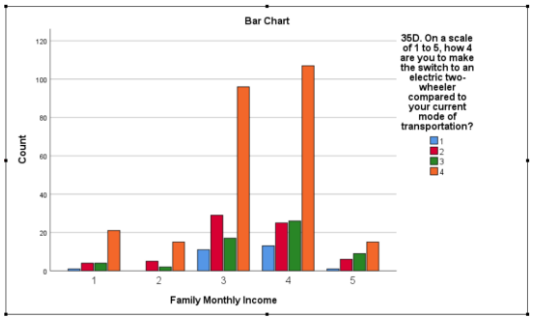

Figure 7

1) The data suggests that individuals with a family monthly income between 1,21,000-2,00,000 show the highest interest in electric two-wheelers, followed by the 81,000-1,20,000 range. Surprisingly, those with incomes above 2 lakhs display less interest. Potential causes include perceptions of affordability, subsidy accessibility, and lifestyle preferences. Higher-income individuals may prioritize luxury vehicles or alternative transportation options like hydrogen cars. Awareness, infrastructure, and product offerings may also influence purchase decisions. To promote wider adoption, targeted education campaigns and incentives could address misconceptions and infrastructure gaps. Policymakers should consider income-specific strategies to encourage sustainable transportation choices.
2) The data indicates that individuals within the income range of 1,21,000-2,00,000 show a higher interest in seeking out information about electric two-wheelers compared to those with incomes above 2 lakhs or within the 30,000-80,000 range. Potential explanations include varying priorities, accessibility to information, and perceived benefits. Middle-income earners may prioritize research due to affordability concerns, while higher earners might rely on pre-existing knowledge or have different purchasing criteria. Lower-income individuals may face barriers such as limited internet access or time constraints. Tailored information campaigns and accessible resources could address these disparities and promote informed decision-making across income groups.

Reliability Test

Case Processing Summary

		N	%
Cases	Valid	402	80.9
	Excluded[a]	95	19.1
	Total	497	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.707	.711	30

The Cronbach's alpha is a measure of internal consistency, which is how well the items in a scale or test measure the same underlying construct. A high Cronbach's alpha (above 0.7) indicates that the items are measuring the same thing.
In our case the reliability is Cronbach's alpha of 0.707: This value indicates acceptable internal consistency for scale measuring factors influencing electric two-wheeler adoption. It suggests that the 30 items are moderately well-correlated and likely measure a similar underlying construct.

3.4Statistical tools

This section elaborates the proper statistical model which are being used to forward the study from data towards inferences. The detail of methodology is given as follows.

3.4.1 Descriptive Statistics

Descriptive Statics has been used to find the maximum, minimum, standard deviation, mean and normally distribution of the data of all the variables of the study. Normal distribution of data shows the sensitivity of the variables towards the periodic changes and speculation.

3.4.2 Model T-test

The t-test is a statistical hypothesis test used to determine if there is a significant difference between the means of two groups. The t-test is typically used when the sample size is small or the population standard deviation is unknown. There are several types of t-tests, but one common type is the independent samples t-test, which compares the means of two independent groups to assess whether they are significantly different from each other.
The process of conducting a t-test involves calculating the t-statistic, which is a measure of the difference between the sample means relative to the variation within the samples. The t-statistic is then compared to a critical value from the t-distribution, taking into account the degrees of freedom and the desired level of significance (usually $\alpha = 0.05$).
If the calculated t-statistic exceeds the critical value, it indicates that there is a significant difference between the means of the two groups. Conversely, if the calculated t-statistic does not exceed the critical value, there is insufficient evidence to reject the null hypothesis, suggesting that there is no significant difference between the means of the two groups.
Overall, the t-test is a valuable tool for comparing means and determining whether observed differences are statistically significant, helping researchers conclude the populations being studied.

3.4.2.1 Multiple Linear Regression Model

Multiple linear regression is a statistical technique used to analyze the relationship between multiple independent variables and a single dependent variable. It extends the simple linear regression model, which examines the relationship between one independent variable and a dependent variable, to include multiple predictors.
In multiple linear regression, the relationship between the independent variables (also called predictor variables or regressors) and the dependent variable is modeled using a linear equation:
$Y = \beta0 + \beta1X1 + \beta2X2 + ... + \beta nXn + \varepsilon$
Where:

- Y is the dependent variable (the variable we want to predict).
- X1, X2, ..., Xn are the independent variables.
- β0 is the intercept term (the value of Y when all independent variables are zero).
- β1, β2, ..., βn are the coefficients (also called regression coefficients) that represent the change in Y for a one-unit change in each respective independent variable, holding all other variables constant.
- ε is the error term, representing the difference between the observed and predicted values of Y.

The multiple linear regression model estimates the coefficients (β0, β1, ..., βn) that best fit the data by minimizing the sum of squared differences between the observed and predicted values of the dependent variable.
To assess the overall fit of the model, various statistical measures such as R-squared, adjusted R-squared, and F-statistic are used. Additionally, hypothesis tests on individual coefficients (β) can determine whether each independent variable has a statistically significant impact on the dependent variable.

3.4.2.2：Anova Model

ANOVA, or Analysis of Variance, is a statistical technique used to compare means among two or more groups to determine whether there are statistically significant differences between them. ANOVA assesses whether the variability between group means is greater than the variability within groups.
ANOVA compares the means of groups by examining the variation in the data and partitioning it into different sources. There are several types of ANOVA, including one-way ANOVA, which compares the means of two or more independent groups, and factorial ANOVA, which examines the effects of multiple independent variables on a dependent variable.

The key components of ANOVA include:

1. **Between-group variation:** This represents the differences in means among the groups being compared. It is calculated by comparing the means of each group to the overall mean of the entire dataset.
2. **Within-group variation:** This reflects the variability within each group, or the differences between individual data points and their respective group means.
3. **F-statistic:** The F-statistic is calculated by dividing the between-group variation by the within-group variation. It represents the ratio of the variability between groups to the variability within groups.
4. **P-value:** The p-value associated with the F-statistic indicates the probability of obtaining the observed results if the null hypothesis (that there are no significant differences between group means) is true. A small p-value (< 0.05) suggests that there are significant differences between group means.

IV. RESULTS AND DISCUSSION

4.1 To assess the level of adoption decision amongst males and female. (T-test)

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Average of Adoption Decision	Male	228	3.4561	.91443	.06056
	Female	157	3.3965	.98549	.07865

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Average of Adoption Decision	Equal variances assumed	2.176	.141	.609	383	.543	.05964	.09790	-.13285	.25214
	Equal variances not assumed			.601	318.800	.548	.05964	.09926	-.13565	.25494

H_0 : There is no significant relationship between adoption of electric two wheelers and genders.
H_1 : The adoption of electric two-wheelers varies significantly between genders.

- The Sig-value is .141 (p >0.05), which suggests that the level of adoption decision among male and female is same. This means that based on your data, we cannot conclude that gender has a meaningful impact on the decision to adopt electric two-wheelers in tier 1 cities.
- This suggests that gender alone does not have a significant impact on the decision to adopt electric two-wheelers based on the available data. Therefore, any observed differences in adoption rates between males and females are likely due to other factors not accounted for in this analysis.

4.2 To analyze the impact of key factors on adopting an electric two-wheeler (Multiple Linear Regression Model)

Key Factors on adopting an electric two-wheeler:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.792[a]	.708	.670	.26448

a. Predictors: (Constant), Average of Infrastructure Factor, Average of Economic Factor, Average of Technological Factor, Average of Personal Barriers

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	4.603	.635		7.245	.000
	Average of Technological Factor	.011	.152	.004	.071	.047
	Average of Economic Factor	.022	.116	-.010	-.193	.034
	Average of Personal Barriers	.114	.111	-.061	-1.032	.203
	Average of Infrastructure Factor	.170	.128	-.074	-1.321	.039

a. Dependent Variable: Average of Adoption Decision

H_0 : There is no significant relationship between the adoption of E2W and key factors like economic, technological, infrastructure, and personal barriers.
H_1 : The adoption of electric two-wheelers is significantly correlated with key factors like economic, technological, infrastructure, and personal barriers.

- **R: 0.792.** In this case. 0.792 indicates a strong positive relationship
- **R-squared:** 0.708. The model explains 70.8% of the variance.
- The P-value of the Technological factor, Economic factor, and infrastructure factor are 0.047, 0.034, and 0.039 which is (p< 0.05), which suggests a positive impact on the adoption of E2Ws.
- The P-value of the Personal Barriers is 0.203 (p> 0.05), It does not have a significant impact on the adoption decision.

Interpretation:

Strong Positive Relationship: The correlation coefficient (R) of 0.792 indicates a strong positive relationship between the key factors and the adoption of electric two-wheelers. This suggests that as the key factors increase, the likelihood of adopting electric two-wheelers also increases.

Variance Explanation: The model explains 70.8% of the variance in the adoption of electric two-wheelers. This indicates that the selected key factors collectively account for a significant portion of the variability observed in the adoption decision.

Significant Impact of Technological, Economic.

Infrastructure Factors: The p-values of the Technological, Economic, and Infrastructure factors (0.047, 0.034, and 0.039 respectively) are all less than 0.05, indicating statistical significance. This suggests that these factors have a positive impact on the adoption of electric two-wheelers. Specifically, improvements in technology, favorable economic conditions, and better infrastructure are associated with higher adoption rates.

Insignificant Impact of Personal Barriers: The p-value of the Personal Barriers factor is 0.203, which is greater than 0.05. This suggests that Personal Barriers do not have a statistically significant impact on the adoption decision. Personal barriers may include factors such as individual attitudes, perceptions, or preferences, which, according to this analysis, do not strongly influence the decision to adopt electric two-wheelers.

Objective 3: To access the level of adoption decision amongst various salary ranges.

- Anova is performed to analyse the Level of adoption decision amongst various salary ranges.

ANOVA

Average of Adoption Decision

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.531	4	.383	.430	.043
Within Groups	357.876	402	.890		
Total	359.407	406			

H_0 : People in different income ranges using electric two-wheelers is not significantly different from one another

H_1 : The adoption of electric two-wheelers varies significantly among people in different salary ranges, indicating that salary level influences the decision to adopt electric two-wheelers.

- The Sig-value is 0.043 (p >0.05), which suggests that the level of adoption decision amongst various salary ranges is different across departments.

Interpretation:

The analysis indicates that the level of adoption decision varies across different salary ranges, as evidenced by a Sig-value of 0.043 ($p < 0.05$). This suggests that salary ranges have a statistically significant impact on the adoption decision among the surveyed individuals. The differences in adoption rates across salary ranges imply that income level plays a role in shaping attitudes and behaviours toward adopting electric two-wheelers.

1. Affordability: Lower-income individuals may face barriers to adopting electric two-wheelers due to cost concerns, while higher-income individuals may have greater financial capacity to invest in sustainable transportation options.
2. Perceptions of Value: Higher-income individuals may perceive electric two-wheelers as a worthwhile investment or status symbol, while lower-income individuals may prioritize other expenses over purchasing such vehicles.
3. Access to Information and Resources: Higher-income individuals may have greater access to information about electric two-wheelers and may be more likely to afford associated costs such as charging infrastructure or maintenance.
4. Policy Implications: Understanding how salary ranges influence adoption decisions can inform targeted policies and interventions aimed at promoting equitable access to sustainable transportation options across income groups.

Findings:

- The research shows that the infrastructure, economic, and technological aspects have a substantial beneficial impact on the adoption of electric two-wheelers, with p-values less than 0.05. This implies that these variables are important in determining whether or not people choose to use electric two-wheelers. To further boost the adoption of electric two-wheelers, manufacturers and companies should concentrate on improving technological developments, offering inexpensive products, and developing infrastructure.
- **Gender**: Given that there is no statistically significant difference in the adoption rate of electric two-wheelers between males and females in tier 1 cities, the data indicates that gender alone does not significantly influence the decision to adopt these vehicles.
- **Key Factors**: The adoption of electric two-wheelers is positively impacted statistically by improved infrastructure, excellent economic conditions, and technological improvements. When taken as a whole, these variables account for 70.8% of the variation in adoption choices.
- **Personal Barriers**: Personal barriers, such as individual views or preferences, certainly exist, but they do not statistically significantly influence the adoption decision; instead, more relevant elements are involved.
- **Salary Ranges**: Adoption decisions vary significantly across different salary ranges, suggesting that income level influences attitudes and behaviors towards electric two-wheeler adoption. Lower-income individuals may face affordability barriers, while higher-income individuals may perceive electric two-wheelers as worthwhile investments.
- **Policy Implications**: Understanding the impact of key factors and salary ranges on adoption decisions can inform targeted policies and interventions aimed at promoting equitable access to sustainable transportation options and overcoming barriers to adoption.

Recommendations:

Targeted Marketing Campaigns: Develop targeted marketing campaigns that emphasize the technological advancements, economic benefits, and infrastructure improvements associated with electric two-wheelers. Tailoring messaging to address specific concerns or barriers identified in the analysis, such as affordability or access to information, can help increase awareness and interest among different demographic groups.

Income based Incentives: Implement income-based incentives or subsidy programs to make electric two-wheelers more affordable for lower-income individuals. This could include subsidies for purchase costs, tax incentives, or financing options tailored to income levels.

Infrastructure Development: Prioritize the development of charging infrastructure and parking facilities in urban areas, particularly in tier 1 cities where adoption rates may be higher. Investing in infrastructure improvements can address concerns related to range anxiety and convenience, making electric two-wheelers a more attractive option for commuters.

Education and Awareness: Initiate educational and awareness efforts aimed at policymakers and customers alike, emphasizing the advantages of electric two-wheelers for the environment, economy, and health. In order to overcome individual obstacles and promote adoption of electric vehicles, accurate information should be given and myths and misconceptions should be debunked.

Research and Development: Encourage further research and development in electric vehicle technology to improve performance, affordability, and accessibility. Collaboration between government, industry, and research institutions can drive innovation and contribute to the continuous improvement of electric two-wheelers.

Policy Support: Advocate for supportive policies at the national and local levels, including incentives for manufacturers, regulatory measures to reduce emissions, and urban planning initiatives that prioritize sustainable transportation options. Policy support is essential for creating an enabling environment for electric vehicle adoption and fostering a transition to cleaner, more sustainable transportation systems.

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REFERENCES

[1] Jayasingh, S., Girija, T., & Arunkumar, S. (2021). Factors influencing consumers' purchase intention towards electric two-wheelers. *Sustai nability*, *13*(22), 12851.

[2] Chakraborty, R., & Chakravarty, S. (2023). Factors affecting acceptance of electric two wheelers in India: a discrete choice survey. *Transpo rt policy*, *132*, 27-41.

[3] Patil, M., & Majumdar, B. B. (2022). An investigation on the key determinants influencing electric two wheeler usage in urban Indian context. *Researc h in Transportation Business & Management*, *43* , 100693.

[4] Cherry, C., & Jones, L. (2009). Electric two wheelers in India and Viet Nam: Market analysis and environmental impacts.

[5] Patil, M., & Majumdar, B. B. (2021). Prioritizing key attributes influencing electric two wheeler usage: a multi criteria decision making (MCDM) approach–A Hyderabad, India case study. *Case Studies on Transport Policy*, *9*(2), 913-929.

[6] Bhatia, M., Chauhan, H., & Kumar, D. (2021). Study of Factors Influencing Consumer Behaviour towards Electric Two-wheelers in Gujarat. *Availab le at SSRN 3984394*.

[7] Bhattacharyya, S. S., & Thakre, S. (2021). Exploring the factors influencing electric vehicle adoption: an empirical investigation in the emerging economy context of India. foresight, 23(3), 311-326.

[8] Shepherd, S., Bonsall, P., & Harrison, G. (2012). Factors affecting future demand for electric vehicles: A model based study. *Transport Policy*, *20*, 62- 74

[9] Liu, H. C., You, X. Y., Xue, Y. X., & Luan, X. (2017). Exploring critical factors influencing the diffusion of electric vehicles in China: A multi stakeholder perspective. Resear ch in Transportation Economics, 66, 46- 58.

[10] Singh, V., Singh, V., & Vaibhav, S. (2020). A review and simple meta analysis of factors influencing adoption of electric vehicles. Transport ation Research Part D: Transport and Environment, 86, 102436.

[11] Plötz, P., Gnann, T., & Wietschel, M. (2014). Modelling market diffusion of electric vehicles with real world driving data— PartI: Model structure and validation. *Ecological Economics*, *107*, 411-421.

[12] Krishnan, V. V., & Koshy, B. I. (2021). Evaluating the factors influencing purchase intention of electric vehicles in households owning conventional vehicles. *Case Studies on Transport Policy*, *9*(3), 1122-1129.

[13] Yong, T., & Park, C. (2017). A qualitative comparative analysis on factors affecting the deployment of electric vehicles. *Energy Procedia*, *128*, 497-503.

[14] Xia, Z., Wu, D., & Zhang, L. (2022). Economic, functional, and social factors influencing electric vehicles' adoption: An empirical study based on the diffusion of innovation theory. *Sustaina bility*, *14*(10), 6283.

[15] Tu, J. C., & Yang, C. (2019). Key factors influencing consumers' purchase of electric vehicles. *Sustain ability*, *11*(14), 3863.