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A STUDY ON CONSUMER AWARENESS OF ELECTRIC VEHICLES IN KHEDA DISTRICT

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ABSTRACT

Electric Vehicles (EV) are vehicles that are either partially or fully powered on electric power. EV is very environmentally friendly as they use little or no fossil fuels (petrol or diesel). The main aim behind doing the research study is to check awareness of electric vehicles in Kheda district. And also study awareness from the perspective of Aware and Purchased Electric Vehicle Respondent and Aware but not Purchased Electric Vehicle Respondent. Usage pattern and the Demographics variables of the respondents in Main Reason to buy an Electric vehicle, Benefits of EV, Statement of EV, Planning to Purchased EV and Visited any EV Showrooms For this purpose, a descriptive study was undertaken with a sample size of 140 Respondents belonging to Aware and Purchased Respondents as well as Aware But Not Purchased Respondents using or Aware of Electric vehicles A structured questionnaire (both Physical and Google Form) was used at the Kheda District, state of Gujarat during the period of 17 January 2022 to 8 February 2022. It can be concluded that by Observing Factor Analysis it is found that the researchers can get two factors named as "Benefits of EV " and “Charging station available”.

KEYWORDS: Electric Vehicles, environmentally friendly, Awareness

1. INTRODUCTION

Electric vehicles are essential because nowadays the price of petrol increases. So, people change their style. And also, the government provides subsidies to the school students as well as academic students. Research on awareness of people towards electric vehicles and what they think about electric vehicles. In rural areas many individuals do not know about electric vehicles and their uses.

An electric vehicle (EV) is a vehicle that uses one or more electric motors for propulsion. It can be powered by a collector system, with electricity from extravehicular sources, or it can be powered autonomously by a battery (sometimes charged by solar panels, or by converting fuel to electricity using fuel cells or a generator). EVs include, but are not limited to, road and rail vehicles, surface and underwater vessels, electric aircraft and electric spacecraft.[1]

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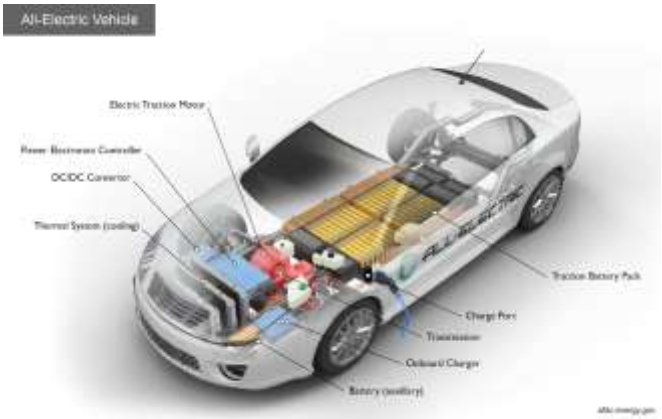
1.3 Electric Vehicles

1.3.1 What is an Electric Vehicle?

An electric vehicle (EV) is one that operates on an electric motor, instead of an internal-combustion engine that generates power by burning a mix of fuel and gases. Therefore, such a vehicle is seen as a possible replacement for current-generation automobiles, in order to address the issue of rising pollution, global warming, depleting natural resources, etc. Though the concept of electric vehicles has been around for a long time, it has drawn a considerable amount of interest in the past decade amid a rising carbon footprint and other environmental impacts of fuel-based vehicles.[2]

1.3.2 How Do All-Electric Cars Work?

All-electric vehicles (EVs), also referred to as battery electric vehicles, have an electric motor instead of an internal combustion engine. The vehicle uses a large traction battery pack to power the electric motor and must be plugged into a wall outlet or charging equipment, also called electric vehicle supply equipment (EVSE).



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Key Components of an All-Electric Car

1) **Battery (all-electric auxiliary):** In an electric drive vehicle, the auxiliary battery provides electricity to power vehicle accessories.
2) **Charge port:** The charge port allows the vehicle to connect to an external power supply in order to charge the traction battery pack.
3) **DC/DC converter:** This device converts higher-voltage DC power from the traction battery pack to the lower-voltage DC power needed to run vehicle accessories and recharge the auxiliary battery.

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4) **Electric traction motor:** Using power from the traction battery pack, this motor drives the vehicle's wheels. Some vehicles use motor generators that perform both the drive and regeneration functions.
5) **Onboard charger:** Takes the incoming AC electricity supplied via the charge port and converts it to DC power for charging the traction battery. It also communicates with the charging equipment and monitors battery characteristics such as voltage, current, temperature, and state of charge while charging the pack.
6) **Power electronics controller:** This unit manages the flow of electrical energy delivered by the traction battery, controlling the speed of the electric traction motor and the torque it produces.
7) **Thermal system (cooling):** This system maintains a proper operating temperature range of the engine, electric motor, power electronics, and other components.
8) **Traction battery pack:** Stores electricity for use by the electric traction motor.
9) **Transmission (electric):** The transmission transfers mechanical power from the electric traction motor to drive the wheels.[3]

1.3.3 Types of Electric Vehicles

There are three types of electric vehicles available: BEV (Battery Electric Vehicles) are 100% powered by electricity. PHEVs (Plug-In Hybrid Electric Vehicles) are cars with an internal combustion engine and a battery charged from an external socket; in other words, they have a plug. Hybrid cars are cars with an electric battery that is charged using the internal combustion engine (they don't have a plug).

BEV: Battery Electric Vehicles, or BEVs. These are cars that are powered only from an electric battery.

PHEV: Plugin Hybrid Electric Vehicles, or PHEVs. These are cars that have both an electric battery and a combustion engine. The electric battery is recharged from a plug.
Hybrid: Hybrid cars have an electric battery and a combustion engine. The electric battery is charged using the combustion engine.[4]

1.5 Advantages & Disadvantages of Electric Vehicles.

1.5.1 Advantages of Electric Vehicles

1) No fuel, no emissions: This is the key point that attracts many people to electric cars. If you want to decrease your personal impact on the environment through transport, then an EV is the way forward. The electric engine within an EV operates on a closed circuit, so an electric car does not emit any of the gases often associated with global warming. No petrol or diesel is needed in a fully electric vehicle, which is great for your carbon footprint.

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2) Running costs: Because you're not paying for petrol or diesel to keep your car running, you can save a lot of money on fuel. At the time of writing, it costs around £63.80 to fill the average unleaded petrol tank for drivers of medium-sized cars in the UK. By comparison, depending upon the electric vehicle you own and the tariff you are on, a full charge of your electric vehicle could cost as little as 96p. With Good Energy's Electric Vehicle Tariff, you could even save £60 a year versus the Big Six's Standard Variable Tariffs, with the additional bonus of the electricity going into your EV being 100% renewable.

3) Low maintenance: We all know cars need a bit of TLC from time to time. Petrol and diesel engines can require expensive engine maintenance over their lifetimes – electric vehicles don't.
Why is this? In a traditional combustion engine, there are hundreds of moving parts which can potentially go wrong, whereas an electric motor has fewer than 20. This means that your EV is likely to have lower long-term maintenance costs than other vehicles.

4) Performance: Most of the fun of owning a car comes from getting out on the roads and putting it to work. In the past, electric vehicles haven't had the sleekest image; many have had low expectations as to how well an electric car can do versus traditional engines.

As more manufacturers have piled into the market with their own take on the electric vehicle, the performance levels of EVs have rocketed. Electric cars are lighter, and – as all of their power is generated from a standing start – their acceleration capability can surprise. Certain brands, such as Tesla, have done a lot to improve people's perceptions of electric vehicles – the Tesla Model S is one of the fastest-accelerating cars on the market, doing 0 – 60mph in just 2.5 seconds.

5) Popularity: If you like to stand out in the crowd then perhaps knowing that electric cars are becoming increasingly more popular might be a negative for you, but for many it's a huge positive. As more EVs find their way onto our roads, we will see the supporting infrastructure expand. There are already over 4800 charging locations in the UK, offering nearly 7500 individual charging points – and these numbers are growing at an ever-increasing rate.

1.5.2 Disadvantages of Electric Vehicles

1) Driving range: The term 'range anxiety' is familiar to those who've done their research on electric cars. The current cohort of EVs are not able to do the sort of long distances that you'd get out of a fossil-fuelled car, but the distance you can travel on a single charge has improved a lot recently and continues to do so. Many of the more common electric cars can now travel 70 – 100 miles, and even more, with only one trip to the charging point. Hybrid electric vehicles can do a lot to reduce range anxiety as the electric motor works in tandem with a combustion engine.

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2) Recharge time: Pulling into the motorway service station because your petrol gauge is flashing at you, refilling, and getting on your way again takes all of five minutes. It's a convenient process that we're all familiar with.

Unfortunately, there is no five-minute recharge for electric cars just yet. However, rapid charging is becoming more common, you'll just need to plan it into longer journeys as even a rapid charge takes 20 – 30 minutes.

3) Battery life: A battery is vital to an electric car; you certainly won't be driving anywhere without one! The batteries currently in use in EVs in the UK do have a limited life expectancy, however, and will need to be replaced every 3 – 10 years depending on the make and model. There's quite a discrepancy in those figures, – 10 years is a lot more than three, so you can already see how the technology has been improving. Battery replacement is a longer-term cost calculation that needs to be remembered when you're considering purchasing an electric vehicle.[5]

2. LITERATURE REVIEW

Ju, N., Lee, K. H., & Kim, S. H. (2021) Despite the positive outlook of various organisations on the prevalence of eco-friendly cars, Korea's electric vehicle market is small, and growth is slow. To identify factors that hinder consumer awareness and the spread of eco-friendly vehicles, news articles and online postings on eco-friendly vehicles from 2006 to 2020 were collected and analysed using text mining techniques. This study found that Korean consumers thought hybrid vehicles were fuel-efficient and quiet; however, there were concerns about battery life and safety due to poor battery performance and complaints about battery replacement. Nevertheless, consumers thought electric cars were sophisticated, luxurious, youthful, clean, and that technical problems would be resolved in the future. The inconveniences of charging and short-distance driving, the expenses and the lack of various dispute settlement measures have been shown to lower the intention to purchase electric vehicles.[6]

Nooraini, I., Osman, N. H., & Mohd Zamani, S. N. (2020) A significant obstacle to the uptake of electric vehicles (EVs) is that consumers lack awareness and do not see them as viable options. A survey to analyse consumers' awareness of existing EVs was conducted toward existing EVs in Malaysia. The focus area is in Langkawi Island, where the place aims to be a low carbon Island by 2030. The understanding of the awareness of air pollution is essential to inform government approaches to addressing this issue. Thus, a comprehensive questionnaire survey was conducted with 506 respondents from Malaysian citizens. Data for this study comes from Malaysian citizens' over the period from August to September 2020 and conducting in Malay language.[7]

Das, S. (2020) Global warming is a big concern of the present era where the whole world is working towards finding ways to be environment friendly and bringing solutions for the same. All the sectors

are trying to work with their go green tactics and being environmentally friendly. Even the two-wheeler sector is trying to help the environment with the innovation of electric two-wheelers and avoiding fuel which can cause higher pollution and harm to the environment. The concept of electric two-wheelers is unique and helpful for the environment but at a very early stage in the market. The adoption and acceptance of the idea by customers are essential for success. The purpose of this paper is to investigate customer perception and awareness towards environment-friendly electric two-wheelers in the Indian Market. It is extremely important in the view of marketers of the electric two-wheelers manufacturer to create awareness among customers about the importance of saving the environment and why paying extra at the time of purchase can give long term benefits to them as well as society. This paper discusses the awareness and perception of potential customers for electric two-wheelers in India. The data is collected from two-wheeler owners and they are asked about their expectations, awareness, and perception about electric vehicles. Results suggest that customers perceived electric two-wheelers as a costlier and less efficient option against fuel-based two-wheelers. They are also sceptical about the performance and longevity of the product. Based on the result it is suggested that the marketers should educate customers about benefits and, long term cost efficiency and profit of the product.[8]

McElgunn, J. (2018) The primary purpose of this study is to investigate the relationship of electric vehicle consumer awareness on the subsequent purchasing patterns of consumers across the globe, in conjunction with other macroeconomic variables. For this study EVs have been defined as hybrid electric vehicles (HEVs) or plug-in electric vehicles (PEVs). Data for this study comes from 33 countries in North America, Europe, Asia, and Oceans over the period from 2011 to 2016. Within the field of research surrounding EV adoption, almost all work has been done at the microeconomic level, this study uses a hybrid macroeconomic approach to bridge the gap in previous literature. In order to gauge consumer awareness at the national level this study utilises Google Trends data, which tracks the search terms at the country level. The main findings of this study include a significant positive relationship between consumer awareness and purchasing patterns. Consistent with previous literature this study found a significant relationship with household income and EV sales using two different metrics, and found that at the regional level greater policy collaboration creates a more conducive environment for EV adoption.[9]

Jin, L., & Slowik, P. (2017) Governments around the world are implementing policies to promote electric vehicles to reduce dependence on oil, decrease greenhouse gas emissions, and improve air quality. In the past few years, annual global electric vehicle sales have been firmly on the upswing, from just hundreds in 2010 to over 500,000 in 2015 and over 750,000 in 2016. The cumulative global market reached the milestone of 1 million electric vehicles in September 2015, and from there quickly grew to 2 million in January 2017. The early market growth for electric vehicles continues, but a

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number of barriers prevent their more widespread uptake. These barriers include the additional cost of the new technology, the relative convenience of the technology considering range and charge times, and consumer understanding about the availability and viability of the technology. This last point, typically referred to as "consumer awareness," is crucial. The development of electric vehicle markets is fundamentally tied to prospective consumers' general awareness and understanding of the potential benefits of electric vehicles.[10]

3. RESEARCH METHODOLOGY

The research design for the study is descriptive in nature. A structured questionnaire will be prepared, pre tested for 10 respondents (both physical and Google Form), validated and used for the purpose of data collection method. A total of 140 respondents were considered as samples. That includes 140 both aware purchase Electric vehicle respondents and aware but not purchased electric vehicles Respondents and check the awareness of electric vehicles. The researcher used a non-probability Convenience sampling method. Sampling Units are taken from Kheda District. These involve Salaried, Self Employed, Professional, Housewife, Retired and Others. The collected data was tabulated and after the validity test, with the help of the SPSS 22 version software. Chi-square test, ANOVA test and Factor Analysis was put to test significant differences in opinion of Benefits of EV and Statement of EV and also the data is presented in the form of tables & graphs.

3. 1 Objective:

1) To check awareness about electric vehicles not only in rural areas but also urban areas.
2) To reduce pollution in areas.
3) To save money.

3.2 Limitation of the research:

The project is majorly based on primary data.

1) Sample size is limited to 140 people.
2) Respondents do not give appropriate answers.
3) Questionnaire for collecting data, so it took more time
4) It is limited by time.

CHAPTER 4 DATA ANALYSIS & INTERPRETATION

4.1 Demographic Details of the Respondents:

Out of 140 respondents, 122 male and 18 females. Considering Age group, the majority of 59 respondents belong to the 18-25 years, 35 respondents are within the 26-35 years and 36-50 years and 11 respondents fall in the 51 and Above age group. Considering Occupation, the majority 51 are Salaried and 47 are Self Employed. 20 are farmers, 12 are Housewife's and 10 are Businessmen. Talking about the Income group, 109 are belonging Below Rs. 30,000 Monthly Income, 23 are

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belonging from Rs. Rs.30001 to Rs. 60,000, 4 are from Rs. Rs.60,001 to Rs. 90,000, 4 are from Rs.90001 and above.

Table 4.1 Demographics details of Respondents

Demographic Details of the Respondents				
Particulars Total (140)	**Number of Respondents**	**Aware Not Purchased**	**Aware Purchased**	**Not Aware**
1) Gender				
Male	122	105	8	9
Female	18	15	2	1
Total	**140**	**120**	**10**	**10**
2) Occupation				
Self-Employed	47	39	3	5
Farmer	20	16	3	1
Businessmen	10	10	0	0
Salaried Person	51	43	4	4
Housewife	12	12	0	0
Total	**140**	**120**	**10**	**10**
3) Age Of Respondents				
18-25	59	48	3	8
26-35	35	29	4	2
36-50	35	32	3	0
51 and above	11	11	0	0

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Total	**140**	**120**	**10**	**10**
4) Monthly Income				
Upto Rs.30000	109	95	5	9
Rs.30001 to Rs.60000	23	17	5	1
Rs.60001 to Rs.90000	4	4	0	0
Rs.90001 and above	4	4	0	0
Total	**140**	**120**	**10**	**10**

4.2 Brand of EV:

Joy E-Bike is the most popular brand of electric vehicle in Kheda district according to aware and Purchased respondents.

Table 4.2 Which of the following brands of Electric Two-wheeler do you have?

Which of the following brands of Electric Two-wheeler do you have?	Number of Respondent
Joy E-Bike	4
Oreva	2
Tunwal	1
Other	3

4.3 Main Reason to buy an Electric Two-Wheeler

From the above table and chart save cost is the main reason to buy an Electric Two-Wheeler from the perspective of an aware and purchasing electric vehicles Respondent. 7 Respondent prefers speed as the main reason to buy an Electric two-wheeler. 6 Respondents prefers Environment and low weight as the main reasons to buy an Electric Two-Wheeler.

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Table 4.3 Main Reason to buy an Electric Two-Wheeler

Main Reason to buy an Electric Two-Wheeler	Number Of Respondent
Environment	6
Save cost	9
low weight	6
Technology Improved	4
Noise free	3
Low maintenance	3
Performance	2
Popularity	1
Speed	7
Riding Range	0

4.4 Benefits of EV:

All the respondents agree with the benefits of electric vehicles except the 2nd and 3rd benefits. In 2nd Benefit most of the respondents neutral about electric vehicles have excellent acceleration. In 3rd Benefits most of the respondents strongly agree that electric vehicles are environmentally friendly

Table 4.4 Benefits of EV:

Benefits	Aware and purchased					Aware and Not Purchased				
	SA	A	N	D	SD	SA	A	N	D	SD
Electric Vehicle are much quieter than other vehicles	1	7	1	1	0	34	54	17	9	6
Electric Vehicle have excellent acceleration	2	4	2	2	0	21	40	47	5	7
Electric Vehicle are environmentally friendly	5	4	1	0	0	58	36	17	5	4
The cost of electric vehicle is much lesser than diesel or petrol vehicle	4	4	1	1	0	18	53	39	4	6
Electric Vehicle cost about the same to buy as petrol or diesel vehicle	1	5	3	1	0	28	35	38	14	5
Electric Vehicle Technology has improved and they now have a much	3	4	2	1	0	24	59	26	6	5

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better range										

4.5 Statements of EV:

All the respondents agree with the statements of electric vehicles except the 1st, 3rd and 5th statement. In the 1st statement, respondents Strongly Agree that electric vehicles are environmentally beneficial. In the 3rd statement, respondents were neutral about the initial purchase cost of electric vehicles much lesser than petrol or diesel vehicles. In the 5th statement, respondents Strongly Disagree that many charging stations are available in the city.

Table 4.5 Statements of EV:

Statement	Aware and purchased					Aware and Not Purchased				
	SA	A	N	D	SD	SA	A	N	D	SD
I think electric vehicles are environmentally benefited	4	5	1	0	0	50	48	16	4	2
I think cost of charge is lesser than the petrol or diesel fuel	2	3	4	1	0	22	50	43	3	2
I feel that initial purchase cost of electric vehicle much lesser than petrol or diesel vehicles	1	4	3	2	0	28	31	49	9	3
I feel that electric vehicles are looking good	5	2	2	1	0	29	52	29	7	3
I think that many charging stations are available in the city	0	0	0	3	7	5	5	19	15	76
I feel that recharge of electric vehicle is easy	2	5	2	1	0	26	46	34	11	3
I think that maintenance cost of electric vehicle is much lesser than petrol or diesel vehicles	3	4	2	1	0	22	58	34	2	4

4.6 Planning to purchase EV (Aware Purchased):

From the above table and chart most of the respondents are planning to purchase Electric vehicles in the future.

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Table 4.6 Are you planning to purchase an Electric vehicle in the Future?

Are you planning to purchase Electric vehicle in the Future?	Yes	No
	7	3

4.7 Electric Vehicle Brands and Model:

Most of the respondents are aware of Hero Electric Optima HX-Single Battery and most of the respondents Interested in Joy E-Bike Wolf.

Table 4.7 Aware and not Purchased Electric Vehicle Brands and Model:-

Brand Name	Model No	Model Name	Aware	Interested
Hero Electric	1	Hero Electric Optima LX	110	10
	2	Hero Electric Optima HX - Single Battery	113	7
	3	Hero Electric Photon Hx	107	13
	4	Hero Electric NYX HX (Dual Battery)	108	12
	5	Hero Electric Optima HX - Dual Battery	110	10
Joy E-Bike	1	Joy e-bike Wolf	67	53
	2	Joy e-bike Glob	91	29
	3	Joy e-bike Monster	98	22
	4	Skyline	109	11
	5	Thunderbolt	97	23
	6	Hurricane	103	17
Ola	1	Ola S1	71	49
	2	Ola S1 Pro	77	43

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Oreva	1	Oreva Blue Alish J50 Plus	106	14
	2	Oreva Alish Electric Scooter	108	12
	3	Oreva Adidev E-Bike	102	18
Tunwal	1	Tunwal Elektrika 60	105	15
	2	Tunwal strom ZX	102	18
	3	Tunwal sports 63 mini	104	16
Bajaj	1	Bajaj Chetak	98	22
Tvs	1	Tvs IQUBE	100	20
Ather	1	Ather 450X	101	19
Pure Energy	1	Epluto	106	14
	2	Epluto 7G	104	16
	3	Entrance Neo	107	13

4.8 Main Reason to buy an EV:

From the above study environment is the main reason to buy an Electric vehicle from the perspective of an aware and not purchasing electric vehicles Respondents. 70 Respondent prefers save cost as the main reason to buy an Electric vehicle. 61 respondents prefer noise free as the main reasons to buy an Electric vehicle. 54 respondents prefer low weight as the main reason to buy an Electric vehicle. 50 respondents prefer speed as the main reason to buy an Electric vehicle. 49 respondents prefer low maintenance cost and Easy to drive are the main reasons to buy an Electric vehicle.

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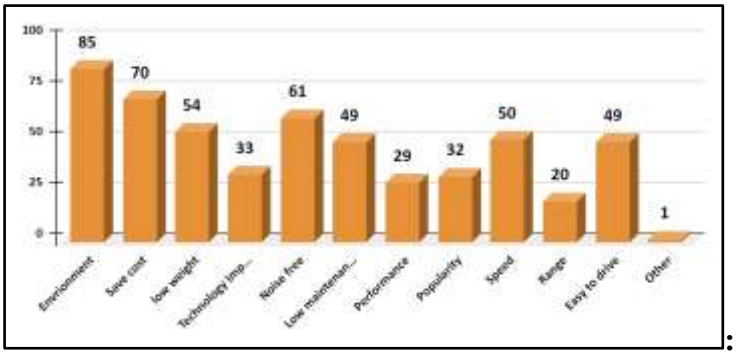
Table No. 4.8 What are the main reasons to buy an Electric vehicle?

Main Reason	Number of Respondent
Environment	85
Save cost	70
low weight	54
Technology Improved	33
Noise free	61
Low maintenance cost	49
Performance	29
Popularity	32
Speed	50
Range	20
Easy to drive	49
Other	1

Graph No. 4.8 What are the main reasons to buy an Electric vehicle?



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4.9 Planning to purchase EV (Aware Not Purchased):

From the above table and chart most of the respondents are planning to purchase Electric vehicles in the future.

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Table No.4.9 Are you planning to purchase an Electric vehicle in the Future?

Are you planning to purchase Electric vehicle in the Future?	Yes	No
	100	20

4.10 Visit any Electric vehicle showrooms:

The table and pie chart shows that most of the respondents have not visited any electric vehicles showrooms.

Table No. 4.10 Did you visit any electric vehicle showrooms?

Did you visit any electric vehicle showrooms?	Yes	No
	26	84

CHAPTER 5 DATA INTERPRETATION

Table No. 5.1 Chi-Square Test Results of All the Models of Electric Vehicles

Brand Name	Model No	Model Name	Chi-Square	P Value	Result
Hero Electric	1	Hero Electric Optima LX	9.729	0.045	Rejected
	2	Hero Electric Optima HX - Single Battery	5.263	0.261	Accepted
	3	Hero Electric Photon Hx	9.381	0.052	Accepted
	4	Hero Electric NYX HX (Dual Battery)	4.06	0.398	Accepted
	5	Hero Electric Optima HX - Dual Battery	9.302	0.054	Accepted
Joy E-Bike	1	Joy e-bike Wolf	3.244	0.518	Accepted
	2	Joy e-bike Glob	7.225	0.124	Accepted
	3	Joy e-bike Monster	3.75	0.441	Accepted
	4	Skyline	2.802	0.591	Accepted
	5	Thunderbolt	3.595	0.464	Accepted
	6	Hurricane	3.224	0.521	Accepted

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Ola	1	Ola S1	2.501	0.644	Accepted
	2	Ola S1 Pro	5.018	0.286	Accepted
Oreva	1	Oreva Blue Alish J50 Plus	3.854	0.426	Accepted
	2	Oreva Alish Electric Scooter	3.027	0.553	Accepted
	3	Oreva Adidev E-Bike	1.702	0.79	Accepted
Tunwal	1	Tunwal Elektrika 60	7.686	0.104	Accepted
	2	Tunwal strom ZX	3.447	0.486	Accepted
	3	Tunwal sports 63 mini	7.289	0.121	Accepted
Bajaj	1	Bajaj Chetak	4.879	0.3	Accepted
Tvs	1	Tvs IQUBE	12.925	0.012	Rejected
Ather	1	Ather 450X	7.194	0.126	Accepted
Pure Energy	1	Epluto	3.854	0.426	Accepted
	2	Epluto 7G	1.384	0.847	Accepted
	3	Entrance Neo	3.206	0.524	Accepted

Interpretation:

Here, the P value is less than 0.05. Therefore, Ho Should be rejected. I.e There is direct association between occupation and Hero electric Optima LX. Here, the P value is less than 0.05. Therefore, Ho Should be rejected. I.e There is a direct association between occupation and TVS IQUBE.

Table No. 5.2 Anova Table

		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Electric Vehicle are much quieter than other vehicles	Between Groups	1.653	3	0.551	0.489	0.69
	Within Groups	141.955	126	1.127		
	Total	143.608	129			
Electric Vehicle have excellent acceleration	Between Groups	2.599	3	0.866	0.828	0.481
	Within Groups	131.778	126	1.046		
	Total	134.377	129			
Electric	Between Groups	3.113	3	1.038	1.007	0.392

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Vehicle are environmentally Friendly	Within Groups	129.818	126	1.03		
	Total	132.931	129			
The cost of electric vehicle is much lesser than diesel or petrol vehicle	Between Groups	7.76	3	2.587	2.911	0.037
	Within Groups	111.963	126	0.889		
	Total	119.723	129			
Electric Vehicle cost about the same to buy as petrol or diesel vehicle	Between Groups	0.368	3	0.123	0.103	0.958
	Within Groups	149.64	126	1.188		
	Total	150.008	129			
Electric Vehicle Technology has improved and they now have a much better range	Between Groups	6.664	3	2.221	2.446	0.067
	Within Groups	114.413	126	0.908		
	Total	121.077	129			

Interpretation:

From the Study of ANOVA table following are Interpretation, By Observing P value which is greater than 0.05. There is no significant difference between income groups and Benefits of Electric Vehicles. Except for one benefit, the cost of an electric vehicle is much less than diesel or petrol vehicle P value is less than 0.05. There is a significant difference between income groups and the cost of electric vehicles is much lesser than petrol or diesel vehicles.

Factor Analysis of Electric Vehicles: -

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Table No. 5.3 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.751
Bartlett's Test of Sphericity	**Approx. Chi-Square**	161.56
	df	21
	Sig.	0

The KMO measures the sampling adequacy which should be greater than 0.5 for a satisfactory factor analysis. From Table 5.3, it can be interpreted that KMO is 0.751, greater than 0.5.

Bartlett's test is another indication of the strength of the relationship among variables. This tests the null hypothesis that the correlation matrix is an identity matrix. An identity matrix is a matrix in which all of the diagonal elements are 1 and all of the diagonal elements are 0 and we want to reject this null hypothesis. From Table 5.3, we can see that Bartlett's test of sphericity is significant, i.e. its associated probability is less than 0.05 means P(0.0000 <0.05) i.e. the significance level is small enough to reject the null hypothesis. This means that correlation matrix is not an identity matrix.

Both of the test results showed that the data is fit for factor analysis.

Table No. 5.4 Total Variance Explained Principal Component Analysis Method of Extraction

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.692	38.46	38.46	2.692	38.46	38.46	2.587	36.964	36.964
2	1.14	16.289	54.749	1.14	16.289	54.749	1.245	17.786	54.749
3	0.779	11.127	65.877						

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4	0.742	10.594	76.47						
5	0.691	9.869	86.34						
6	0.528	7.545	93.885						
7	0.428	6.115	100						

PRINCIPAL COMPONENT ANALYSIS

Principal Component analysis was used for extracting factors and two factors were retained depending on Eigenvalues and variance explained. Eigenvalue represents the total variance explained by each factor. The standard practice normally used is that all the factors with an Eigenvalue of one or more should be extracted. It can be seen in Table 5.4 that there are two factors having Eigenvalues more than 1. All the factors extractable from the analysis along with their Eigenvalues, the percent of variance attributable to: each factor, and the cumulative variance of the factor and the previous factors. It can be noticed from the above Table The first factor accounts for 38.46% of the variance, the second 16.289%. All the remaining factors are not significant. Thus, two factors have been extracted. And the solution of factor analysis gave Two factors, which explained the 54.749% total variance. The results were obtained through varimax rotations and all the loadings greater than 0.50 were retained.

Table No. 5.5 Naming of Factors

SR. No	Factors	Statement No.	Statements	Factor Loading
1	Benefits of EV	1	I think electric vehicles are environmentally benefited	0.633
		2	I think cost charge is lesser than the petrol or diesel fuel	0.683
		3	I feel that initial purchase cost of electric vehicle much lesser than petrol or diesel vehicles	0.633
		4	I feel that electric vehicles are looking good	0.688
		6	I feel that Recharge of electric vehicle is easy	0.7

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		7	I think that maintenance cost of electric vehicle is much lesser than petrol or diesel vehicles	0.668
2	Charging station available	5	I think that many charging stations are available in the city	0.914

ROTATED MATRIX

It can be interpreted from the above table that total 2 factors are extracted and various statements are grouped under these factors, with their respective factor loading with the help of a rotated matrix generated in SPSS. The rotated matrix has revealed that respondents have perceived the first factor "Benefits of EV" to be the most important factor generated from the combination of statement no. 1,2,3,4,6,7 with the highest explained variance of 38.46% (Table 5.4). The second important factor called “Charging station available” is the combination of variable 5 has explained variance of 17.786 (Table 5.4)

6. FINDINGS AND CONCLUSIONS

- After Collecting data of 140 respondents, it is said that 122 are Males and 18 are Females.
- The study shows that 92.9% of people are aware of electric vehicles.
- Joy E-Bike is the most popular brand of electric vehicle in Kheda district according to aware and Purchased respondents.
- Save cost is the main reason to buy an Electric wheeler from the perspective of an aware and purchasing electric wheeler Respondent. 7 Respondent prefers speed as the main reason to buy an Electric vehicle. 6 Respondents prefers Environment and low weight as the main reasons to buy an Electric Two-Wheeler.
- From the perspective of aware and Purchased Electric Vehicle Respondent 70% respondents are planning to purchase Electric vehicles in the Future.
- Study shows that environment is the main reason to buy an Electric vehicle from the perspective of an aware and not purchasing electric vehicles Respondents. 70 Respondent prefers save cost as the main reason to buy an Electric vehicle. 61 respondents prefer noise free as the main reasons to buy an Electric vehicle. 54 respondents prefer low weight as the main reason to buy an Electric vehicle. 50 respondents prefer speed as the main reason to buy an Electric vehicle. 49 respondents prefer low maintenance cost and Easy to drive are the main reasons to buy an Electric vehicle.

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- From the perspective of aware and Not Purchased Electric Vehicle Respondent 83.33% respondents are planning to purchase Electric vehicles in the Future.
- From the perspective of aware and Not Purchased Electric Vehicle Respondent 76.4% Respondents are have not visited any electric vehicles showrooms.

By testing Chi-Square, it is found that there are some rejected hypothesis are as follows

- There is a direct differentiation among occupations and Hero electric Optima LX.
- There is a direct differentiation among occupations and TVS IQUBE.
- There is no direct differentiation among age groups and awareness of electric vehicles.
- It can be concluded that by Observing Descriptive table of ANOVA, most of the respondents agree with Income and Benefits of Electric Vehicles. By Observing ANOVA Test it is found that There is no significant difference between income and Benefits of Electric Vehicles.
- It can be concluded that by Observing Factor Analysis it is found that the researchers can get two factors named as "Benefits of EV" and “Charging station available”.

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