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Consumer Perception on the adoption of Electric Vehicle from an Indian Context- An Empirical Study

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Abstract: *Governments from many countries are encouraging people to switch to electric cars by offering financial incentives. According to earlier studies, challenges to consumer acceptability include the high cost of an electric car, the lack of charging infrastructure, and time and range concerns. Participants in the study are Indians who now own cars. To assess the data, structured equation modeling was employed. (SEM). A potent mediator in the adoption of electric vehicles has been identified as attitude (ATT). A few policy recommendations are offered for a more successful, long-term policy framework for India's future adoption of electric vehicles. For underdeveloped nations like India, research on crucial hurdles and insufficient charging infrastructure is addressed.*

Keywords: *Electric Vehicle; Charging infrastructure; Battery; Technology; Consumer perception;*

1. INTRODUCTION

Less energy is used, fewer greenhouse gases (GHGs) are produced, and less noise is made by electric vehicles. The following are the several kinds of electric vehicles: HEV: Hybrid electric vehicles (HEVs) have an electric motor and an engine that is powered by both electricity and petrol. Electricity produced by the braking system is used to recharge the battery. PHEV: Compared to HEVs, plug-in hybrid electric vehicles (PHEVs) feature smaller engines and stronger batteries. Electricity produced by the braking system is used to recharge the battery. The batteries are recharged using either the braking system or an external electric source. Objectives of the study Implementing electric vehicles all over India, aiming toward green energy generation, Establishing EVs across the country

2. RESEARCH METHODOLOGY

Primary information was gathered from students, professors, businesspeople, housewives, and people with a variety of occupations using a standardized questionnaire. To guarantee that the data gathered is representative of the target community, the sample was chosen based on particular criteria, including their age, gender, and educational level. The questionnaire asked about EV-related topics including preferred EV over the motorcycle, EV range over the motorcycle, advancements in technology, battery satisfaction, and other relevant topics. The questionnaire was thoughtfully created to ensure that the questions are simple to comprehend, and it was carefully conducted to gather accurate and trustworthy results. A lot of thought went into the process of getting informed consent, safeguarding the participants' privacy, and addressing ethical issues. Secondary information was gathered from a variety of sources, including books, journals, research papers, and websites. A viewpoint on Electric Vehicle Adoption from an Indian Context was the subject of a detailed analysis of the literature and research that has already been done on the subject. To guarantee that the sources reviewed were of the highest caliber and relevance, the search terms and keywords used to identify pertinent literature were carefully chosen. The credibility, dependability, and applicability of the study questions were among the criteria used to critically analyze the sources consulted. The knowledge acquired from the secondary sources served to support the analysis and interpretation of the primary data as well as the development of the research questions and strategy. Overall, to guarantee that the study questions are answered precisely and dependably, both primary and secondary data sources were carefully chosen and gathered. The techniques used to gather and analyze the data were created with the intention to producing precise and trustworthy findings from which it would be possible to draw solid inferences about the perspective on the uptake of electric vehicles in the Indian context.

3. HISTORY AND BACKGROUND

Electricity was one of the main sources of automobile power in the late 19th and early 20th centuries because it provided a level of comfort and operability that gasoline-powered cars could not achieve. The fleet of electric cars peaked at roughly 30,000 cars at the turn of the century. Electric vehicle interest has increased as a result. People who drove electric cars in cities, where their limited range was not an issue, found them to be popular. Another aspect that contributed to its success was the lack of a gear change, making it a straightforward choice. There were no vibrations nor sounds. The fact that it didn't require manual activation was also advantageous. Acceptance of electric vehicles has been modest.

3. 1. *Competitor's analysis*

Leading companies like OLA Electric Mobility Pvt, Ather Energy, and Mahindra Electrics are expanding their market presence quickly in response to the opportunity that India's EV industry affords. In addition, governments like Karnataka and Tamil Nadu are implementing timely, innovative investor-friendly policies in addition to developing the required infrastructure. By establishing Tesla India Motors and Energy Pvt Ltd in Bengaluru, Tesla Inc., an American electric vehicle and renewable energy corporation, recently established its foothold in India. In February 2021, Ather Energy, the nation's first producer of intelligent electric vehicles, moved its US$86.5 million manufacturing facility from Bengaluru to Hosur. (Tamil Nadu).

3.2. *Local vs national vs global analysis of electric vehicle*

Is India Prepared for a Revolution in Electric Vehicles? Road transportation is undergoing a revolution thanks to electric cars (EVs). Over the past five years, the global EV market has grown 43% annually on average; in 2019, the percentage of EVs sold globally was 2.6%. Electric vehicles are strongly focused in the recently proposed US plan as well as several COVID-19 recovery strategies across nations, including China, Germany, France, Canada, and others. Deloitte predicts that new EV sales will exceed USD 30 million annually by 2030. China, Europe, and the US are currently ahead of India in terms of significance. Worldwide EV usage reached 7.2 million in 2019, with 47% of those vehicles being used in China, 25% in Europe, and 21% in the US. However, India is very interested in EVs. Road transportation is electrified for a variety of reasons. It is a green industrial strategy that aids in the recovery of the economy after an epidemic. It aims to increase energy security and decrease crude imports.

3.3. Latest Technology

In 20 years, there will be 500 million electric vehicles on the road, predicts a recent study by Bloomberg NEF. In order to get there, the EV charging infrastructure must be greatly increased to support a variety of charging scenarios. So to get there, the EV charging infrastructure must be greatly increased to support a variety of charging scenarios. Furthermore, this shift would be driven primarily by technological advancement. In this article, we'll take a closer look at five technologies that will directly affect how drivers experience EV charging, support new EV charging business models, and create fresh revenue opportunities for the complete EV ecosystem. Since it permits two-way energy transfer between the automobile and the grid, vehicle-to-grid (V2G) is a vital part of managing the energy used for EV charging.V2G enables energy stored in an EV to be provided back to the grid, reducing system load during times of high consumer demand. Given that the typical vehicle is parked for about 95% of the day, V2G connectivity has the potential to enhance grids by using millions of EVs as decentralized energy storage resources with no capital or operational costs. By using this strategy, EV owners can decrease their power use and save money on EV charging by adopting "prosumers"—grid consumers and energy producers. These developments will influence EV charging in the future, speeding up EV consumption. The latest innovations will completely transform the EV charging experience, support new EV charging business models, and create exciting new opportunities for participants in the e-mobility

4. REVIEW OF LITERATURE

Chan, (2002) The transportation industry must adopt more environmentally friendly technologies in response to environmental challenges. Electric vehicles (EVs) are thought of as a green form of transportation. The paper's main focus is on batteries because they are essential to make electric vehicles more cost-effective, environmentally friendly, and useful in daily life. Neumann, (2010) The introduction of electric vehicles can be seen as a safety measure and a guarantee of future security from an environmental standpoint, given the rise in high CO2 emissions and the depletion of fossil fuel reserves. The technology that will be used in the future EV is quite advanced and, on the upswing, allowing for efficient and comfortable long-distance travel. M Pierre, C Jemelin, N Louvet (2011) Similar incidents have happened over the past few decades; they were undoubtedly less dramatic but educational: in the 1990s, certain local governments sponsored innovations based on electric vehicles, and some individuals elected to use these vehicles for their daily commutes. Using research from 2006 and 2008, we plan to explain the causes of this novel mode of transportation, highlight the challenges faced at the time by electric vehicle users, and examine the usage patterns that influenced their mobility and use of electric vehicles. Rezvani, Jansson, and Bodin (2015) provide an overview of the studies on the adoption of electric vehicles, however, they only concentrate on the psychological aspects that are unique to each person and that affect their intention to adopt an electric vehicle. They also only choose a small number of representative studies.To complement it, our review examines a wider range of adoption-influencing factors for electric vehicles than just psychological constructs. Additionally, by compiling all academic studies on electric vehicle preferences, we present a thorough picture of the state of the field

today. Sierzchula et al., (2014); Ghasri et al., (2019) To assist governments and automakers in determining consumer preferences, demand studies have examined the financial, technical, fundamental, and political aspects of EVs (Liao et al., 2017). Several factors impacting EV purchasing decisions have been discovered, including driving range, recharge time, and ownership expenses. Some research have examined the variation in consumer preferences while selecting to buy an electric vehicle by utilising expressed preference approaches. Ghasri, Ardeshiri, & Rashidi, (2019) Australia-based researchers have discovered three factors that have an impact on how people perceive electric vehicles: car design, environmental impact, and safety. Price, driving distance, and body type were constructed to interact with each other as separate latent variables by the researchers, who then calculated the influence on generations X, Y, and Z. Compared to Generations X and Z, Generation Y showed the least sensitivity to the cost of electric vehicles, according to the research. According to the researcher, when it comes to government regulations and subsidies, initial price incentives have a bigger influence on how people view electric vehicles than operating cost incentives do.He, Zhan, & Hu, (2018) According to the study's framework for determining how Chinese people perceive things, there are two personality types—personal innovativeness and environmental concern—that have a direct bearing on an individual's attitude towards electric vehicles by influencing their decision to buy one in a positive or negative way. Additionally, it was found that all positive utilities, with the exception of perceived surroundings, have a beneficial impact on perception, and the same is true of negative utilities.Krishna, Rokkam, & Venkteshwar, (2020) A significant factor in EV sales is how customers view EVs. The research has also demonstrated a direct correlation between consumer perceptions of EVs and EV sales. As a result, it is essential for the automobile industry to pay attention to consumer perception because it is key to growing sales and retaining competitive advantage. Additionally, it is advised that the government work to change the way that potential buyers view electric vehicles in order to market them as the way of the future. Shareeda, Al-Hashimi, & Hamdan, (2021) a study was conducted in Bahrain to examine the determining variables, possibilities, and difficulties that electric vehicles experienced as they gained popularity. The study came to the conclusion that people's attitudes towards electric vehicles were significantly influenced by their capacity to pay and their purchasing power. However, the lack of infrastructure and limited range make it difficult for consumers to adopt electric vehicles, although the well-publicized range and government subsidies help. The analysts also noted that EVs would have a new market segment and the future of the automotive industry from a marketing and commercial viewpoint. Onat, (2022) tries to understand the sustainability impacts of alternative fuel vehicle. In the course of the study the researcher has taken into consideration both EV and ICE. The researcher says that adopting more of EV might reduce greenhouse gas emission but it can impact the water resources. ICE is already having various environmental and societal challenges. The researcher in the process has developed a model using various aspects of sustainability. In the process of the study that researcher has taken into understanding the aspects of resource availability. The researcher has suggested that the in the search of alternative fuel source the aspect which is least considered is the solar energy which can serve as the best alternative fuel option in the future. The study favors the battery vehicles charged through solar energy over any other aspect. Vakil, et al., (2021), it was concluded through that mostly young people in Coimbatore were interested in the purchase of electric vehicles, where style, value for money, quality, looks and brand played a positive role in the perception building towards electric vehicles, whereas the cost had no impact on the perception of individuals as they all belonged to higher income groups.

5. RESEARCH GAP

The development of novel vehicle control strategies that generate higher fuel economy is a hot research topic. It takes into account the economic, environmental, and sociological effects of transportation. Driving behaviour changes (such as eco-driving and eco-routing) and powertrain operation changes can be classified into two groups. (e.g., an optimal energy management strategy, or optimal EMS). One of the most important barriers to electric vehicle adoption in India is range anxiety. The ability of electric car owners to travel from point A to point B before the battery runs out is a common concern. This problem is directly related to India's inadequate electrical infrastructure. High expense: Electric and internal combustion engines are not priced equally in India. Automobiles powered by electricity cost much more than those powered by petroleum. The FAME proposal excludes the majority of electric vehicles. By offering incentives and discounts for electric vehicles, the Indian government tried to encourage the use of electric mobility throughout the nation. The terms and requirements of the FAME scheme do not support the vast majority of electric vehicles. Low-speed electric two-wheelers and lead-acid battery-powered electric vehicles are not covered by FAME. On the other side, high-speed EVs require a driver's licence and a registration fee. In order to get the newest cars, many buyers are reluctant to acquire electric vehicles. In some ways, a state's lifestyle will be better and its odds of having amazing vehicle leeway will increase the more mature and peaceful it is.

5.1. Socio Economic and political determinants of the market (PESTLE Analysis)

Political factors: Government policies and laws have a significant impact on how the EV industry develops. Governments all over the world have passed laws and rules to promote the use of electric vehicles, which include tax credits and subsidies for producers and consumers, requirements for their use by government fleets, and investments in charging infrastructure.

Economic Factors: The cost of EVs is a significant factor that affects their uptake. As EVs get cheaper, more people will probably switch to them. Market factors the cost of EVs is a significant factor in determining their uptake. As EVs get cheaper, more people will probably switch to them. Social Factors: The EV sector is growing as a result of increasing awareness of the environment and sustainability. Consumers are more aware of the carbon footprint they leave and how their actions affect the environment. Technological Factors: Technology developments have been an important factor in the

growth of the EV business. Future growth in EVs is also anticipated to be the integration of linked and artificial intelligence technologies. Legal Factors: Governments have also adopted tax credits, subsidies, and other incentives for both producers and customers to assist the expansion of the EV business. These regulations work to lower the price of EVs, increasing their accessibility and affordability for customers. Environmental Factors: The EV business is growing as a result of the greater focus given to renewable energy sources and the move towards a low-carbon economy.

6. PRIMARY DATA AND ANALYSIS

The study measured variables related to the perception on electric vehicle adoption from an Indian context. The results showed that the female respondents are comparatively higher than the male respondents. The majority of responses collected are 55 respondents belonging from the age group under 25. The occupation with the highest responses are businessmen. Majority respondents belong from Jayanagar. The respondents belonging to joint family are comparatively Higher than the nuclear family. The respondents belonging to Classification of response based on the EV owned by the responders of where Athar is higher comparatively to other vehicles. The highest number of respondents believe in EV and strongly agree that EV is a better option to adopt since it is environment friendly. We are presenting our research findings using graphs and tables:

TABLE 1. Classification of responses based on Gender

Gender	Frequency	Percentage
Male	51	49%
Female	53	51%
Total	104	100%

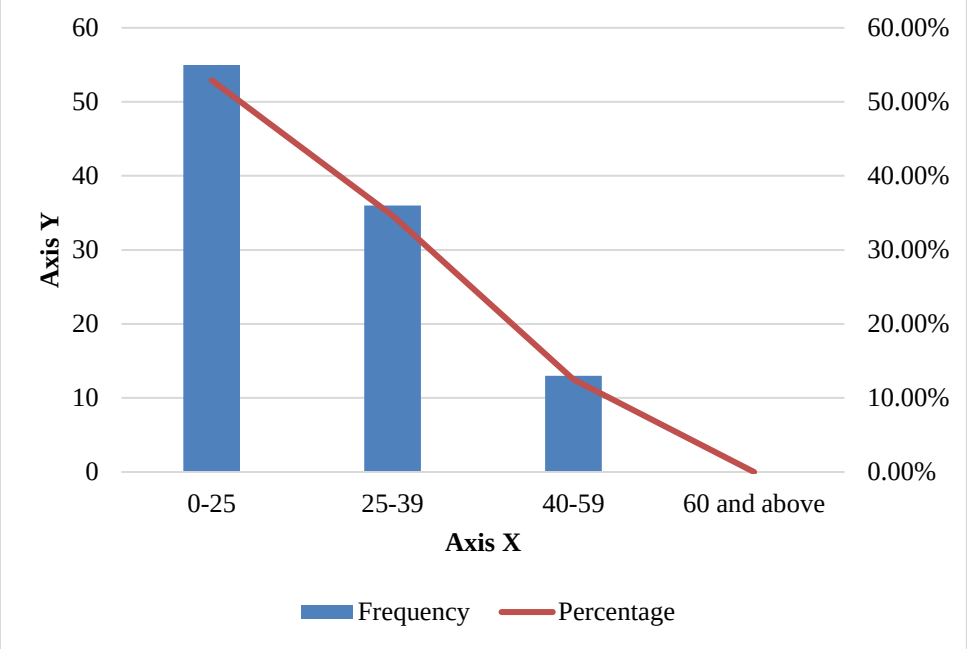

FIGURE1. Classification of responses based on Gender

The above table no.1 and figure no.1 represents the classification of respondents based on Gender. There are 51 Male respondents and 53 Females respondents. The female respondents are comparatively higher than the male respondents.

TABLE 2. Classification of responses based on Age group.

Age Group	Frequency	Percentage
0-25	55	52.90%
25-39	36	34.60%
40-59	13	12.50%
60 and above	0	0%
TOTAL	104	100%

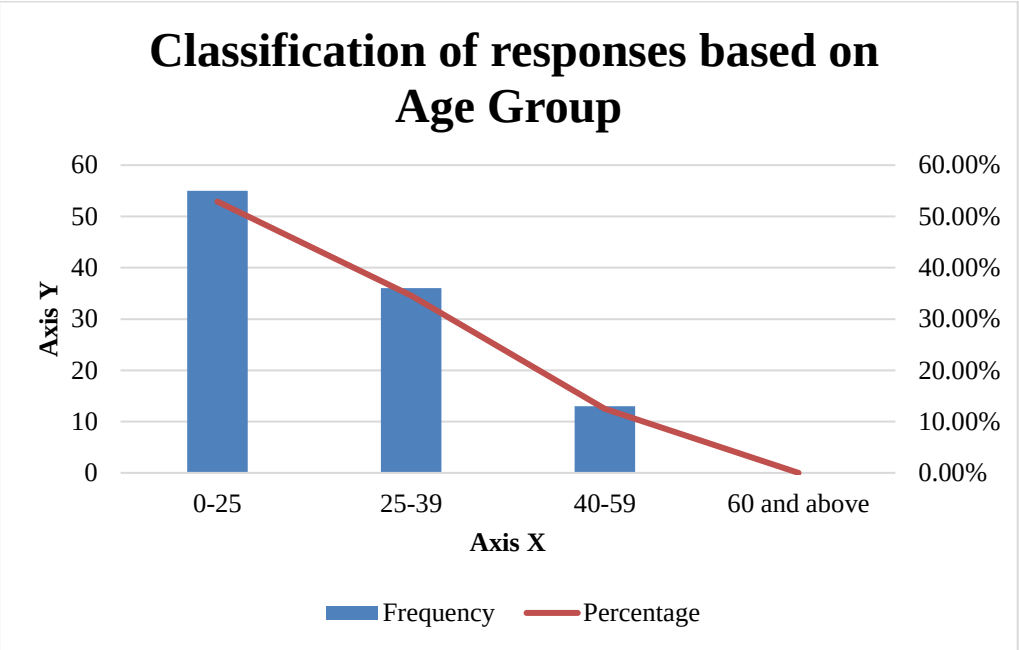

FIGURE 2. Classification of responses based on Gender

The above table no.2 and figure no. 2 represents the classification of respondents based on Age groups. The Study includes 55 respondents belonging from the age group under 25, 36 respondents belonging under 39 and 13 respondents belonging from the age group under 59. No respondents were found from the age group of 60 and above.

TABLE 3. Classification of responses based on occupation.

Occupation	Frequency	Percentage
Housewife	19	18.30%
Businessman	39	37.50%
Salaried	19	18.30%
Pensioner	2	2%
Petitioner	2	2%
Student	20	19.20%
Chartered Accountant	3	2.70%
TOTAL	104	100.00%

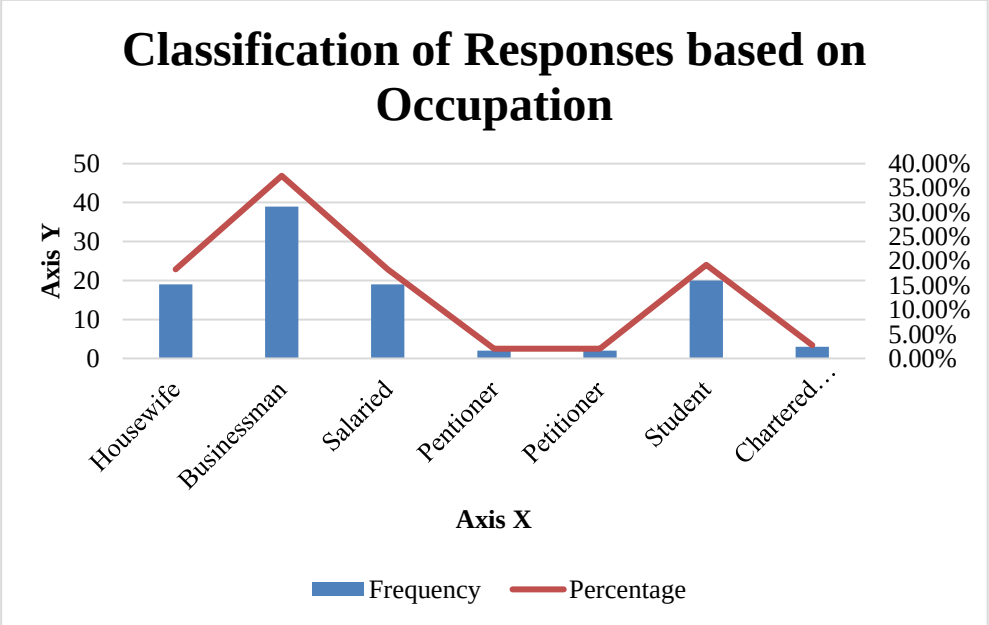

FIGURE 3. Classification of responses based on Gender

The above table no. 3 and figure no. 3 represents the classification of respondents based on Occupation. The Study includes 19 respondents from housewives, 39 respondents from businessmen, 19 respondents are salaried persons, 2 respondents are Pensioner, 2 respondents are petitioner, 20 responses are Students and 3 responses from Chartered Accountant. The occupation with the highest responses is businessmen.

TABLE 4. Classification of responses based on locality

Locality	Frequency	Percentage
Jayanagar	20	19.20%
VVPuram	17	16.30%
Banashankari	9	8.70%
Nagarathpete	14	13.50%
Koramangala	9	8.70%
Jayanagar	6.3	6.14%
TOTAL	104	100.00%

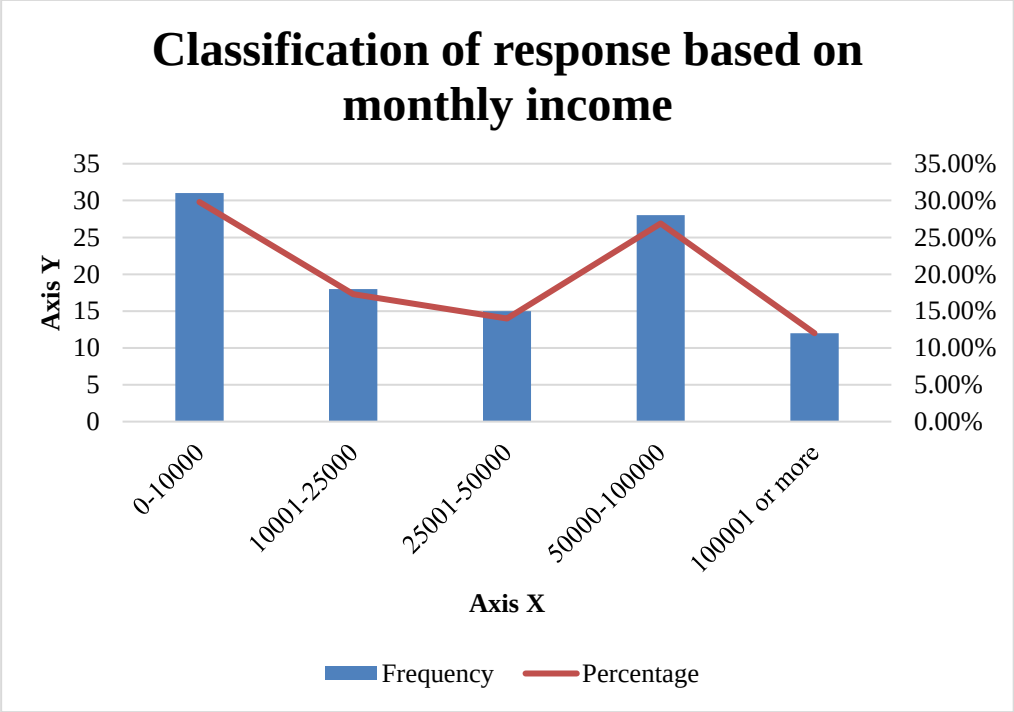

FIGURE 4. Classification of responses based on locality

The above table no.4 and figure no.4 represents the classification of respondents based on locality. The study includes 20 respondents from Jayanagar, 17 respondents from Puram, 9 respondents from Banashankari, 14 respondents from Marathe, 9 respondents from Koramangala and other respondents are from varied areas of Bangalore.

TABLE 5. Classification of response based on monthly income.

Income	Frequency	Percentage
0-10000	31	29.80%
10001-25000	18	17.30%
25001-50000	15	14.00%
50001-100000	28	26.90%
100001 or more	12	12.00%
Total	104	100.00%

The above table no.5 and figure no.5 represents the classification of respondents based on income. The study includes 31 respondents belonging to the income group of rupees under 10,000. 18 respondents belonging to the income group of rupees 10,0001 to 25,000. 15 respondents belonging to the income group of rupees 25,001 to 50,000, 28 respondents belonging to the income group of rupees 50,001 to 1,00,000 and 12 respondents belonging to the income group of rupees beyond 1,00,000.

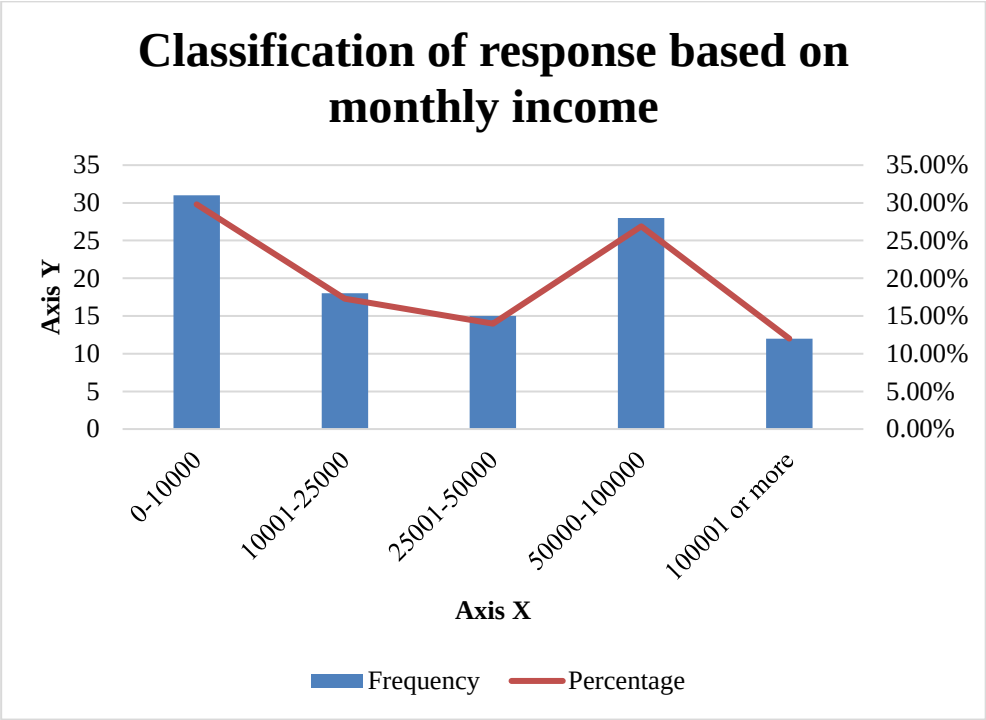

FIGURE 5. Classification of response based on monthly income

TABLE 6. Classification of response based on family type

Family type	Frequency	Percentage
Joint family	44	42%
Nuclear family	60	58%
Total	104	100%

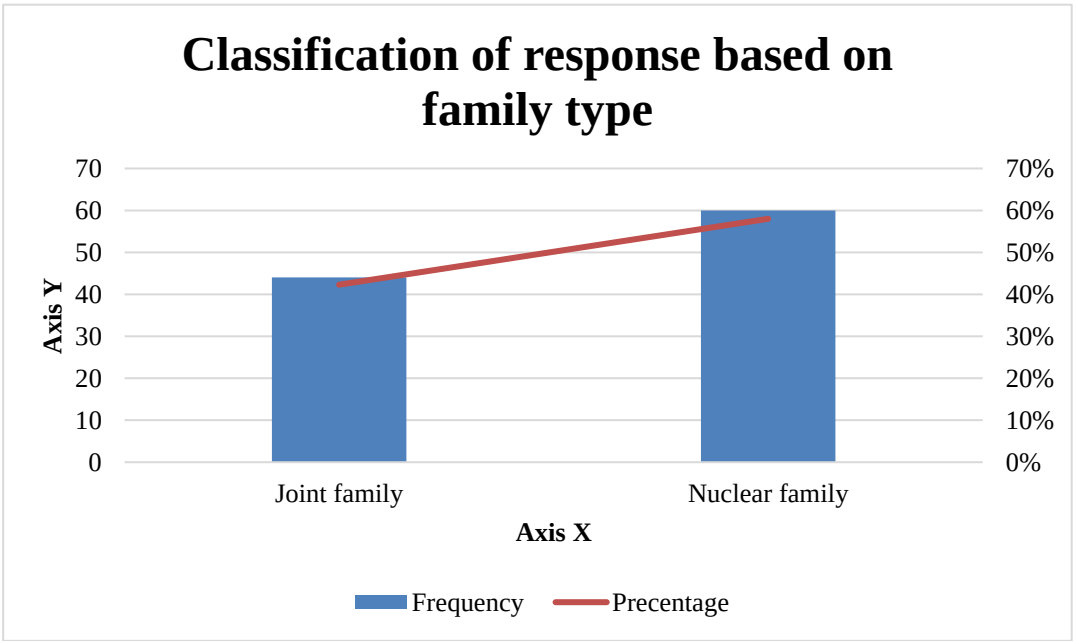

FIGURE 6. Classification of response based on family type

The above table 6 figure 6 represents the classification of respondents based on family type The study includes 44 respondents belonging from joint family and 60 respondents belonging from nuclear family .The respondents belonging to joint family are comparatively Higher than the nuclear family.

TABLE 7. Classification of responses based on ownership

Electric Vehicle	Frequency	Percentage
OLA	12	11.50%
ATHER	57	55%
TVS	5	4.80%
IQCUBE	10	9.60%
CHETAK	10	10%
HERO	6	6%
OTHERS	4	3.80%
TOTAL	104	100%

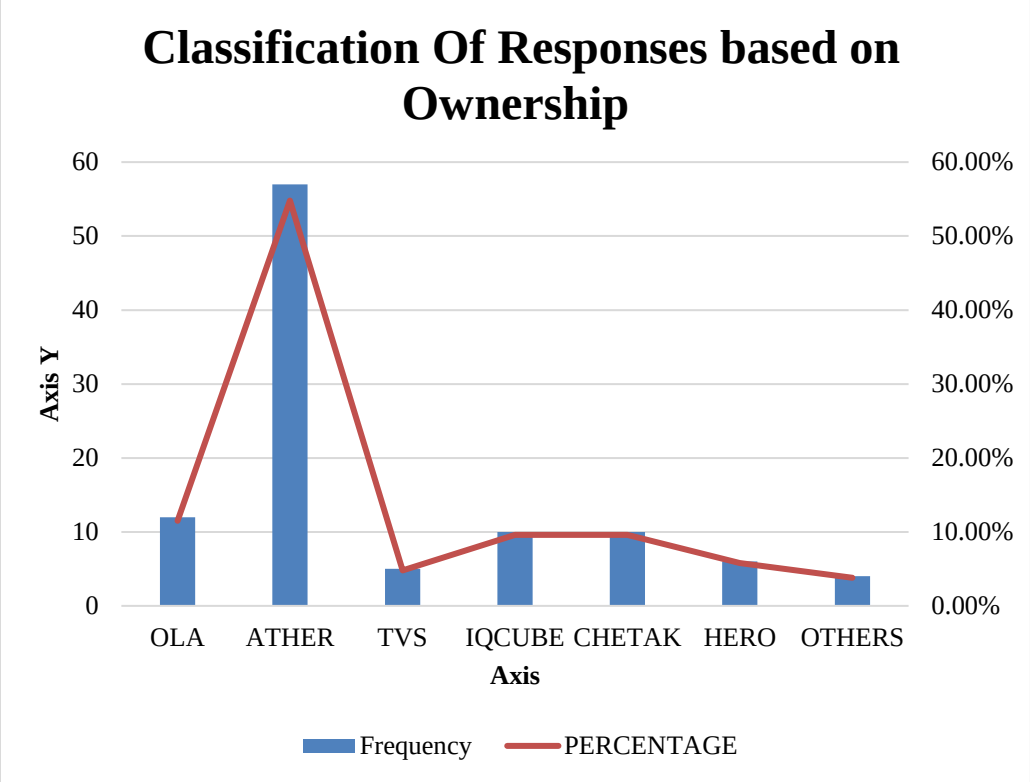

FIGURE 7. Classification of responses based on ownership

The above table no 7 figure and 7 represents the Classification of response based on the EV owned by the responders. The study includes 12 respondents belonging from ola ,57 from Athar, 5 from TVS, 10 from IQCUBE ,10 CHETAK,6 HERO, 4 OTHERS. The respondents belonging to Classification of response based on the EV owned by the responders of where ATHER is higher comparatively to other vehicles.

TABLE 8. Classification of responses based on EV Range over motor cycle

PERCEPTION	Frequency	Percentage
Excellent Acceleration	49	47.10%
Pocket Friendly	39	37.50%
Environment Friendly	55	52.90%
Not worth	13	12.50%
Battery	19	18.30%
Make less noise	27	26%
Easy to adopt	30	28.80%
Total	232	223%

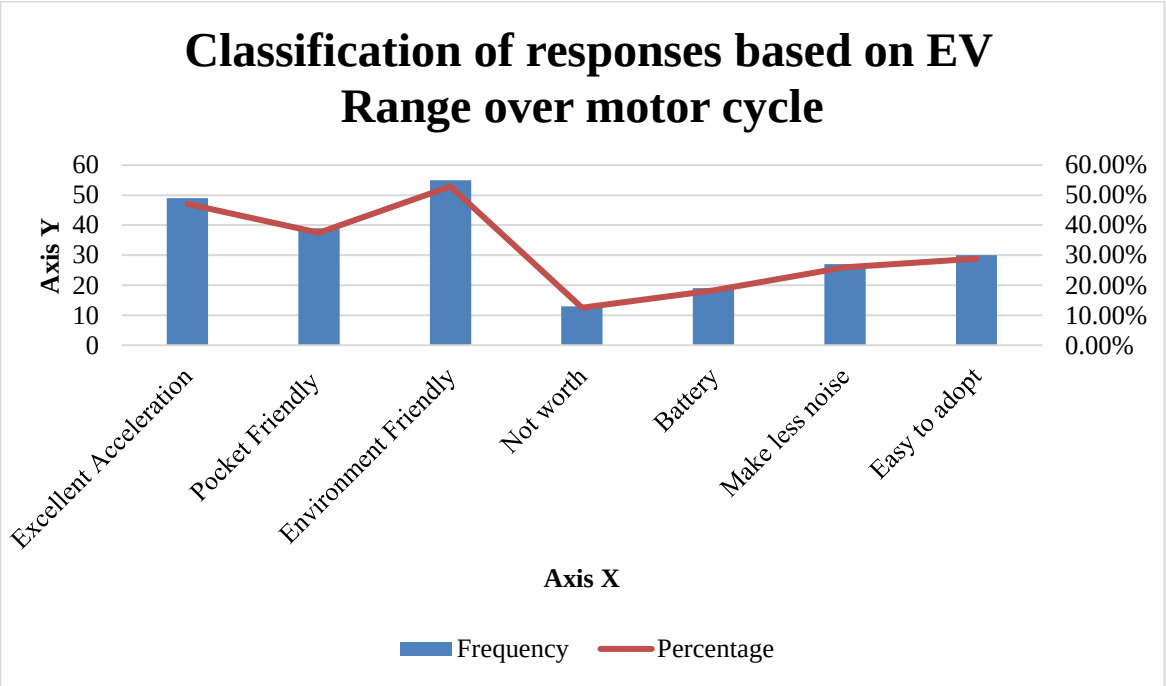

FIGURE 8. Classification of responses based on EV Range over motor cycle

The above table no 8 and figure 8 represents the Classification of response based on the perception on EV range over conversion of Motor vehicles. The study includes 49 respondents belonging to excellent acceleration, pocket friendly ,39 and environment friendly ,55 not worth 13 battery ,19 make less noise 27 easy to adopt 30. The highest number of respondents belonging to the Environment friendly.

TABLE 9. Classification of response based on EV preference over motor cycle

Perception	Frequency	Percentage
Strongly Agree	36	34.60%
Agree	44	42.30%
Neutral	21	20.20%
Disagree	3	2.90%
Total	104	100%

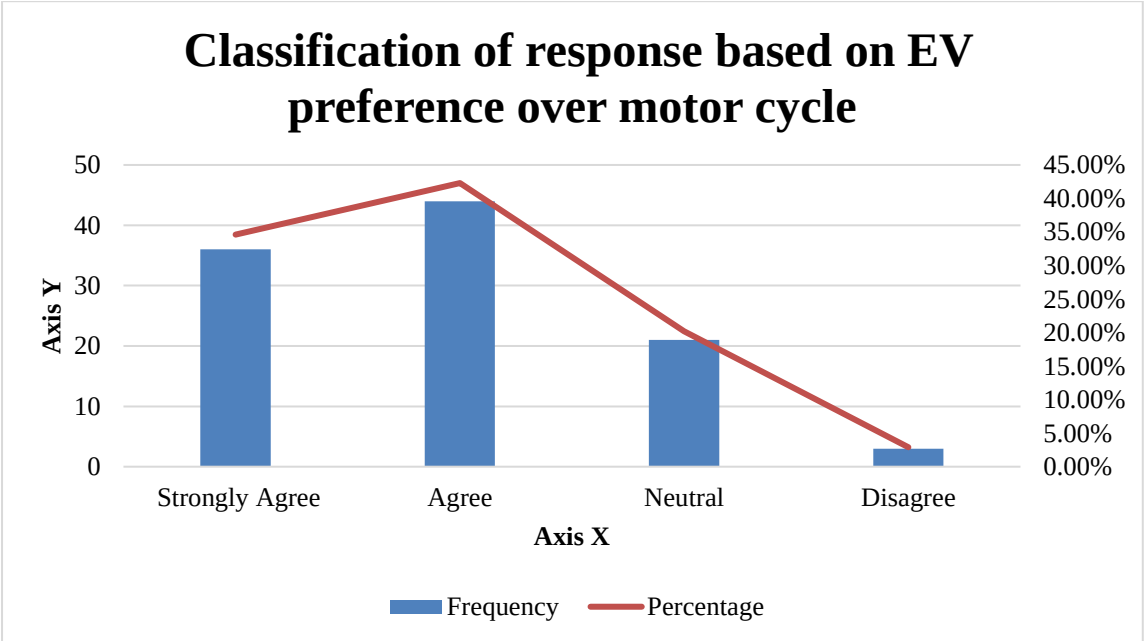

FIGURE 9. Classification of response based on EV preference over motor cycle

The about table number 9 and figure 9 represents the classification of respondents based on the preferences for easy over motor vehicles. The study includes 36 respondents which is strongly agreed, 44 is partially agreed 21, neutral and 3 disagree. The partially agreed respondents are higher compared to the other respondents.

TABLE 10. Classification of response based on the technology improvement

Perception	Frequency	Percentage
Strongly Agree	32	30.80%
Agree	40	38.50%
Neutral	28	27%
Disagree	4	3.70%
Total	104	100%

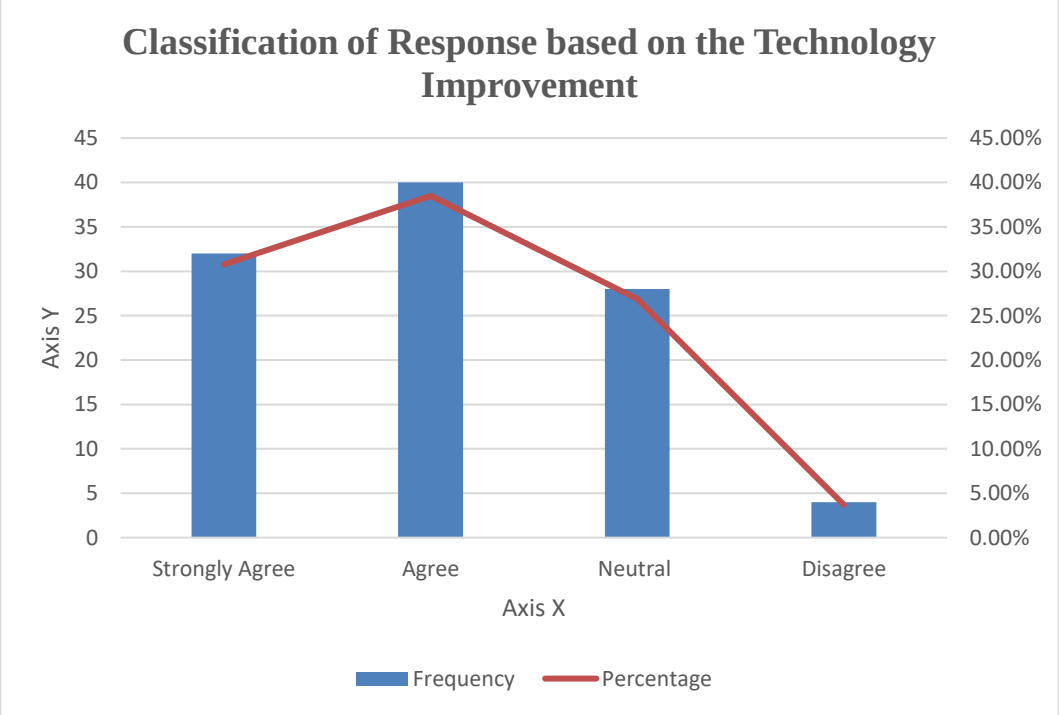

FIGURE 10. Classification of response based on the technology improvement

The above table number 10 and figure 10 represents the classification of respondent these under technology improvement. The study includes 32 respondent s which is strongly agreed whereas 40 partially agreed ,28 neutral and 4 disagree. The partially agreed respondents are higher compared to the other respondents.

TABLE 11. Classification of Responses based on Battery Satisfaction

Perception	**Frequency**	**Percentage**
Strongly Agree	21	20.20%
Agree	39	37.50%
Neutral	33	31.70%
Disagree	10	9.60%
Strongly Disagree	1	1%
Total	104	100%

The above table no .11 and figure no. 11 represents the classification of respondents on the basis of satisfaction of the battery. The study includes 21 respondents who strongly agree, 39 respondents who partially agree, 33 respondents who are neutral, 10 respondents who disagree and 1 respondent that strongly disagrees. The partially agreed respondents are higher compared to the other respondents.

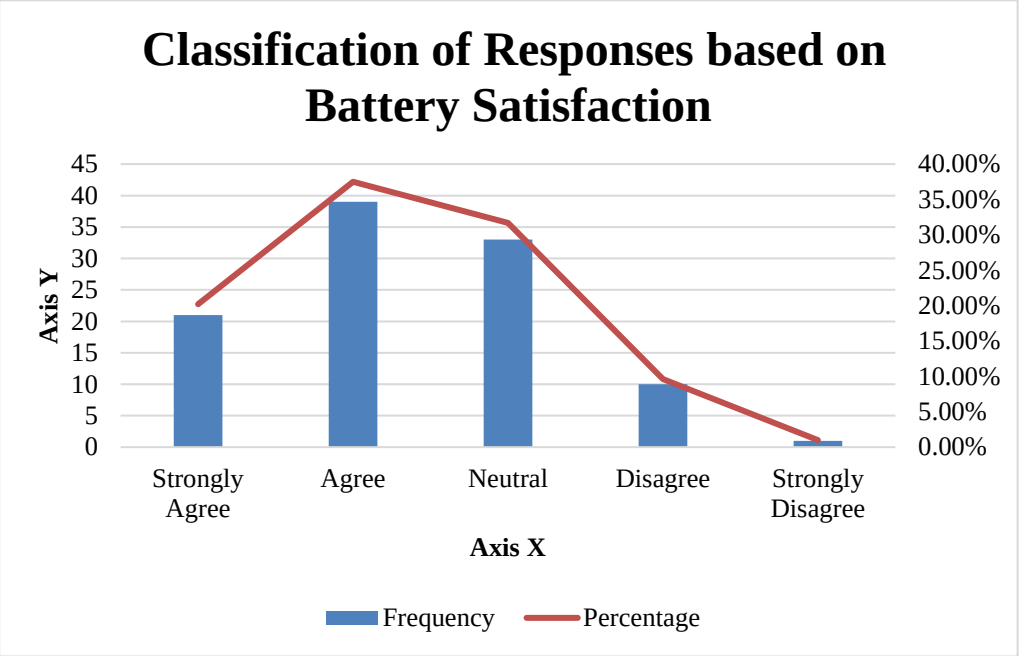

FIGURE11. Classification of Responses based on Battery Satisfaction

TABLE 12. Classification of responses based on charging place preference

Place	Frequency	Percentage
Home	73	70.20%
Charging station	22	21.20%
Change the battery	9	8.70%
Total	104	100%

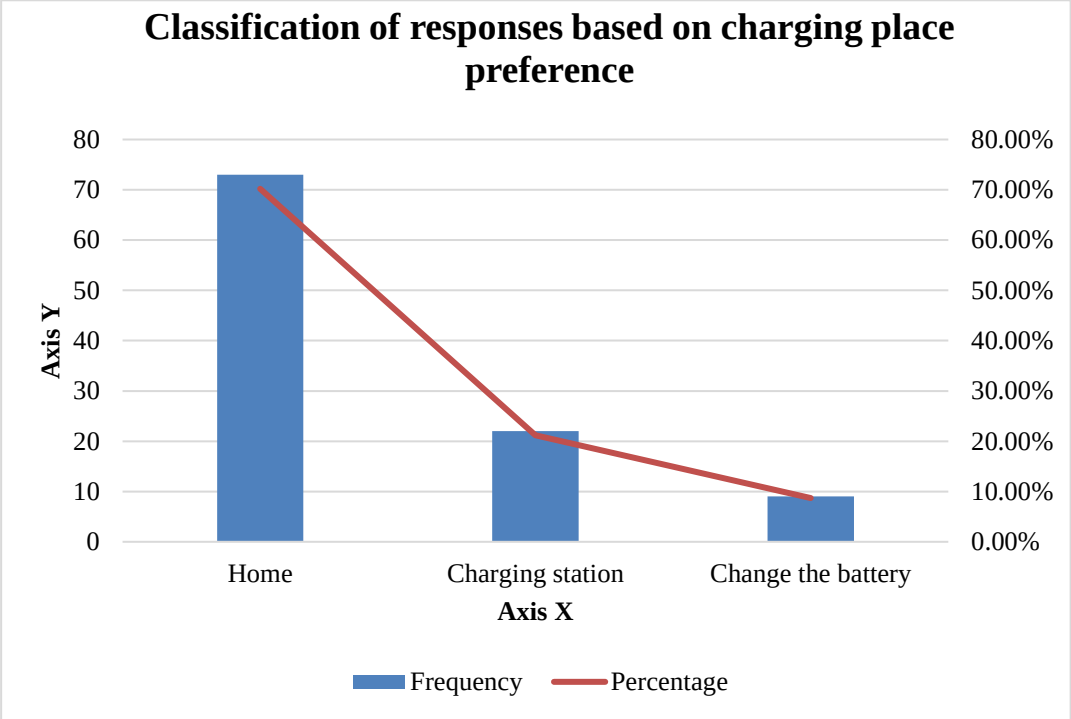

FIGURE12. Classification of responses based on charging place preference

The above table no .12 and figure no. 12 represents the classification of respondents on the basis of charging place preference. The study includes 73 respondents that prefer home charging, 22 respondents that prefer charging at the station and 9 respondents who prefer changing the battery. The respondents that prefer charging at home are the highest compared to charging at station or changing the battery.

TABLE 13. Classification of responses based on charging station

Charging station	Frequency	Percentage
AC level one	39	37.50%
AC level two	14	13.50%
DC fast charge	51	49%
Total	104	100%

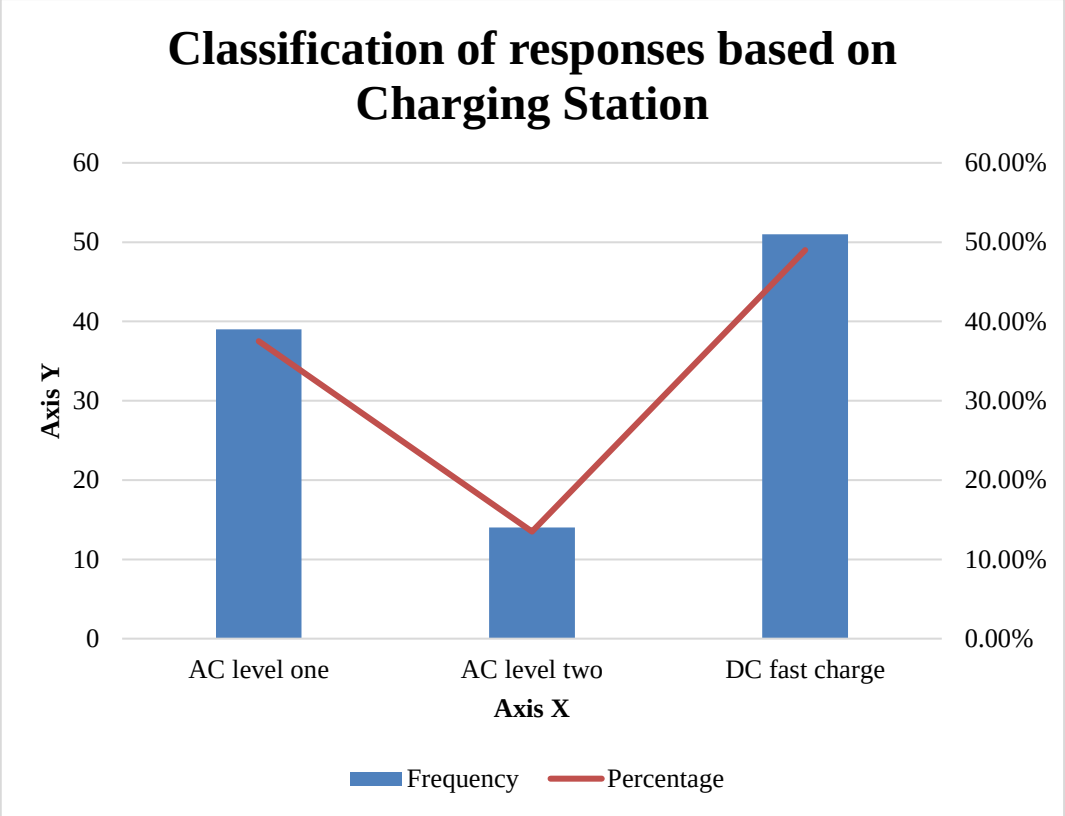

TABLE 13. Classification of responses based on charging station

The above table no.13 and figure no.13 represents the classification of respondents on the basis of charging station. The study includes 39 respondents who prefer AC level one, 14 respondents preferring AC level two and 51 respondents who prefer DC fast charge. Therefore, respondents who prefer DC fast charge are more compared to others.

Table 14. Classification of responses based on number of EV owned

Ownership	Frequency	Percentage
1	76	73.10%
2	21	20.20%
3 or more	7	6.70%
Total	104	100%

The above table no.14 and figure no.14 represents the classification of respondents based on ownership of EV. The study includes 76 respondents that own one EV. 21 respondents that own two EV and 7 respondents that own three or more EVs. Respondents owning 1 EV are higher compared to other respondents.

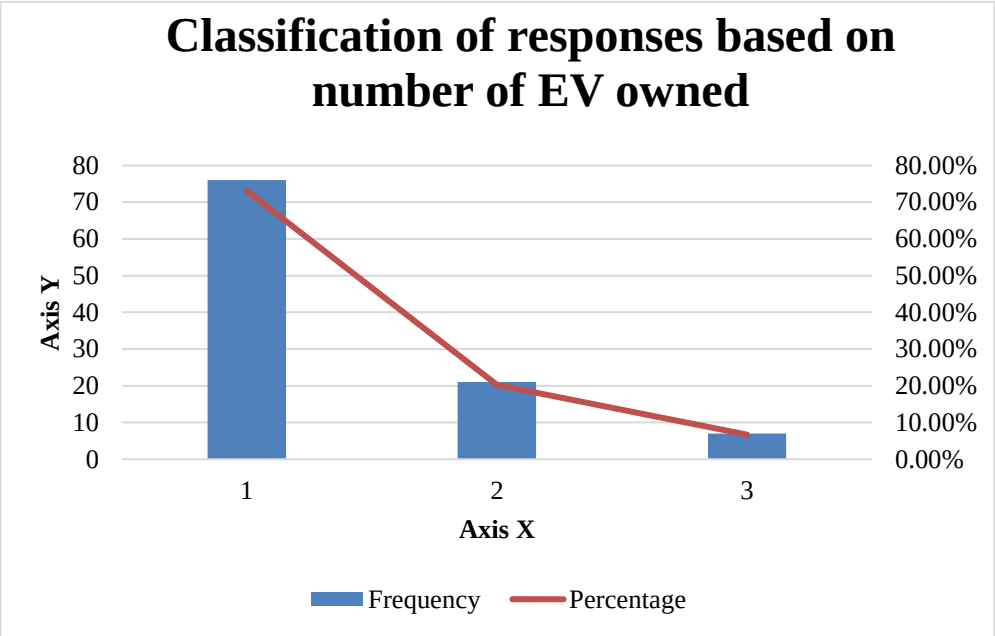

FIGURE14. Classification of responses based on number of EV owned

7. CONCLUSION

Lao PDR must be prepared to introduce various EVs and associated infrastructures as they appear one after the other on the global market, even though participation in their manufacturing and sale is not necessary. Without any constraints, private industry has already started to produce electric cars (EVs). However, building a fundamental system to prevent improper EV operation and transmit accurate EV knowledge to the general public is essential. Depending on the type of EV, EV development is in a different stage. The high cost of EV batteries prevents larger types of EVs from currently competing with ICE vehicles in terms of vehicle running costs, despite the fact that small types of EVs already have a cost advantage over ICE vehicles throughout the course of their lives. Governments in developed nations frequently provide subsidies for electric vehicles as a result.

REFERENCES

[1]. Pierre, M., Jemelin, C., & Louvet, N. (2011). Driving an electric vehicle. A sociological analysis on pioneer users. Energy Efficiency, 4(4), 511-522.

[2]. Rezvani, Z., Jansson, J., & Bodin, J. (2015). Advances in consumer electric vehicle adoption research: A review and research agenda. Transportation research part D: transport and environment, 34, 122-136.

[3]. Høyer, K. G. (2008). The history of alternative fuels in transportation: The case of electric and hybrid cars. Utilities Policy, 16(2), 63-71.

[4]. Bhalla, P., Ali, I. S., &Neumann, (2018). A study of consumer perception and purchase intention of electric vehicles. European Journal of Scientific Research, 149(4), 362-368.

[5]. Glerum, A.,Sierzchula et al, L., Thémans, M., & Bierlaire, M. (2014). Forecasting the demand for electric vehicles: accounting for attitudes and perceptions. Transportation Science, 48(4), 483-499.

[6]. He, X., Zhan, W., & Hu, Y. (2018). Consumer purchase intention of electric vehicles in China: The roles of perception and personality. Journal of Cleaner Production, 1060-1069. doi:https://doi.org/10.1016/j.jclepro.2018.08.260.

[7]. Krishna, M. S., Rokkam, R. A., & Venkteshwar, A. (2020). The client perception of electric vehicles and its impact on sales. International Journal of Applied Research, 6(10), 735-739.

[8]. Shareeda, A. R., Al-Hashimi, M., & Hamdan, A. (2021). Smart cities and electric vehicles adoption in Bahrain. JOURNAL OF DECISION SYSTEMS. doi:10.1080/12460125.2021.1911024

[9]. Ghasri, M., Ardeshiri, A., & Rashidi, T. (2019, Dcember). Perception towards electric vehicles and the impact on consumers' preference. Transportation Research Part D: Transport and Environment, 77, 271-291. doi:https://doi.org/10.1016/j.trd.2019.11.003

[10]. 10. Onat, N. C. (2022). How to compare sustainability impacts of alternative fuel Vehicles? Transportation Research Part D, 102, 103129. doi:10.1016/j.trd.2021.103129