Who Will Buy Electric Vehicles in Malaysia? A Demographic Analysis using Logistic Regression

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ABSTRACT

The adoption of electric vehicles (EVs) in Malaysia remains limited despite increasing environmental awareness and government incentives. This study aims to identify the demographic factors that influence Malaysians' likelihood to purchase EVs using logistic regression. A survey was conducted among 271 urban adults in Malaysia, collecting data on variables including age, gender, education level, income, number of cars owned, and weekly driving distance. Logistic regression analysis revealed that age, monthly income, and education level significantly affect the intention to purchase EVs. Specifically, younger individuals those with higher income, and respondents with diploma qualifications were more likely to consider buying EVs. Conversely, gender, car ownership, and driving distance were not significant predictors. The findings offer valuable insights for policymakers and manufacturers to design targeted strategies that promote EV adoption, contributing to Malaysia's sustainable transportation goals and carbon reduction efforts.

Keywords: Electric Vehicles, Malaysia, Demographic Factors, Logistic Regression, Purchase Intention

INTRODUCTION

An electric vehicle is a car that is powered by an electric motor and draws electricity from a battery. EV is energy efficient and more cost-effective as it uses less fuel [2]. EVs are also more comfortable since they generate very little vibration and noise. A lot of effort has been made to facilitate the adoption of EVs such as irreversible consumer and supplier subsidies, enhancing the construction of the charging infrastructures, and issuing a series of relevant convenient policies for EVs in their daily use and maintenance. The electric vehicles market is broadly divided into two segments, namely, Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs). The penetration rate of EVs in Malaysia is still cited to be very low despite the greater environmental consciousness and governmental incentives. As evidenced by the Department of Statistics Malaysia (DOSM) in 2024. Out of approximately 856,249 registered vehicles, only 28,048 were electric, representing 1.95% of those on the road. One of the main barriers is the absence of empirical evidence about the demographic characteristics of potential electric vehicle buyers. Thus, this research is necessary to identify the demographic profiles that influence Malaysians' likelihood to purchase EVs using logistic regression. The research objective of this study is to identify the demographic factors that influence Malaysians' likelihood to purchase EVs using logistic regression. The findings of this study will have significant implications for both governments and electric vehicle (EV) manufacturers.

LITERATURE REVIEW

This study aims to investigate the demographic factors that influence Malaysians' intention to purchase EVs. To support this analysis, previous literature was reviewed to highlight the relevance of each independent

variable included in the model. Age has consistently been identified as a key demographic factor in EV-related studies. It is found that middle-aged individuals, particularly those between 35 and 44 years old, are more inclined to adopt electric vehicles, likely due to higher financial capacity and long-term planning [11]. In contrast, younger individuals in their twenties exhibited a significantly lower intention to purchase EVs due to financial limitations and uncertainty regarding EV infrastructure [10]. It is further supported the notion that age is associated with both financial readiness and long-term value consideration, which are essential in evaluating EV ownership [5]. Gender has also received attention in the context of EV adoption, although findings remain mixed. For example, [16] and [6] reported that women were more receptive to EVs due to environmental and safety concerns. On the other hand, [7] and [10] found that male respondents showed stronger intentions to purchase EVs, citing interest in performance and innovation as key motivations. These inconsistencies suggest that gender-related attitudes toward EVs may vary by cultural and socioeconomic context, warranting further examination in Malaysia. Education level has been shown to influence consumer awareness and evaluation of electric vehicles. In general, individuals with higher education levels are assumed to possess greater financial literacy and environmental awareness, both of which contribute to a higher intention to purchase EVs. It is found that individuals with academic degrees are more likely to adopt EVs in developed countries [15]. However, in emerging markets like China, those with postgraduate degrees were more critical of EV shortcomings and therefore less likely to purchase them in the short term. [14] highlighted that consumers with bachelor's degrees tend to respond more to EV-related incentives, while those with lower qualifications prioritize cost-based factors such as purchase subsidies and license plate policies. These findings suggest that the relationship between education level and the intention to purchase EVs is complex and may depend on how consumers interpret policy instruments and technological limitations. Income level is widely recognized as a major enabler of EV adoption. [4] noted that high-income households are significantly more likely to purchase EVs, especially in areas with advanced infrastructure and favourable policies. Similarly, [16] demonstrated a strong positive association between income and the intention to purchase EVs in China, reinforcing the role of financial capacity in supporting sustainable mobility. [3] found similar patterns in Turkey, where higher-income and environmentally conscious individuals showed a greater willingness to pay a premium for alternative fuel vehicles. Income not only enhances purchasing power but also improves eligibility for loans and access to charging infrastructure, which are essential for EV ownership. The number of cars owned per household has also been explored as a proxy for wealth and lifestyle. [15] suggested that families with more vehicles are generally more capable of incorporating an EV into their household fleet, often as a secondary vehicle. [10] supported this view by indicating that multi-car households are more likely to consider purchasing EVs, especially for short-distance use. However, the effect of car ownership on the intention to purchase EVs may vary, depending on whether the household views EVs as complementary or substitutive to their current transportation assets. Weekly driving distance serves as an indicator of travel habits and transportation needs, which may influence EV suitability. [11] argued that EVs become more cost-effective for users with higher mileage, particularly in suburban or rural areas where public transport is limited. [8] found that in multi-vehicle households, vehicles with lower daily mileage were often replaced with EVs due to their limited driving range. [12] reported that the average minimum acceptable range before purchasing an EV was 346 kilometres. These findings suggest that weekly driving distance may influence how consumers evaluate the practicality of owning an EV, especially in terms of charging needs and battery efficiency. To model the intention to purchase EVs, logistic regression is commonly employed due to its suitability for binary dependent variables. The model allows for the inclusion of both continuous and categorical predictors, providing interpretable coefficients that indicate the likelihood of the event occurring. [9] and [1] applied logistic regression to examine various factors influencing EV adoption and found it to be effective in handling mixed data types. Its robustness and ease of interpretation make it a suitable method for identifying significant predictors and informing policy decisions. In summary, the review of past studies affirms the relevance of the demographic variables selected in this research which are age, gender, education level, income, number of cars owned, and weekly driving distance in influencing the intention to purchase EVs. These studies also support the appropriateness of logistic regression as a statistical tool for examining the relationship between personal characteristics and EV purchase behaviour within the Malaysian context.

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METHODOLOGY

This study adopted a quantitative research design to examine the demographic factors that influence Malaysians' likelihood of purchasing electric vehicles. Data were collected through a structured online questionnaire distributed via convenience sampling. The target population comprised Malaysian residents aged 18 years and above. The questionnaire was designed to gather demographic information, including age, gender, monthly income, education level, number of cars owned and weekly driving distance along with the respondents' willingness to purchase an electric vehicle. A total of 312 valid responses were obtained and used for analysis. Logistic regression analysis was employed to identify the relationship between the demographic variables and the willingness to purchase electric vehicles, which was treated as a binary outcome variable (Yes or No). This method was chosen due to its suitability for modelling binary dependent variables and determining the likelihood of occurrence based on predictor variables. Before the analysis, the data were screened and cleaned to ensure completeness and consistency. The logistic regression analysis was conducted using IBM SPSS Statistics software. The statistical significance of each independent variable was assessed, and the resulting odds ratios were interpreted to determine the extent to which each demographic factor influenced the probability of purchasing an electric vehicle. This analysis was conducted to fulfill the objective of identifying the demographic profile of potential electric vehicle buyers in Malaysia.

RESULTS AND DISCUSSION

The objective of this study is to identify the demographic factors that influence Malaysians' likelihood to purchase EVs using logistic regression. The table below shows the output for logistic regression.

TABLE 1 LOGISTIC REGRESSION MODEL

Variables	Estimate Coefficient	Standard Error	P-value
Age	-0.051	0.016	0.002
Gender	-0.088	0.300	0.768
Monthly Income	0.166	0.052	0.002
Education Level SPM	2.073	0.764	0.007
Education Level Diploma	2.124	0.693	0.002
Education Level Degree	1.202	0.382	0.002
Number of Cars Owned	1.188	0.211	0.373
Weekly Driving Distance	0.000	0.001	0.734
(Intercept)	0.388	0.664	0.559

$$\ln\left(\frac{p}{1-p}\right) = 0.388 - 0.051(Age) - 0.088(Gender) + 0.166(Monthly\ Income) + 2.073(EducationSPM) + 2.124(EducationDiploma) + 1.202(EducationDegree) + 1.188(CarsOwned) + 0(WeeklyDrivingDistance)$$

The interpretation of the logistic regression model was further supported using odds ratios, which indicate the likelihood that Malaysians will purchase an electric vehicle based on specific demographic characteristics. An odds ratio greater than one indicates a positive association with the likelihood of purchase, whereas a value less than one indicates a negative association.

TABLE 2 ODDS RATIO MODEL

Variable	Estimate Coefficient
Age	0.950
Monthly Income	1.180
Education Level SPM	7.945
Education Level Diploma	8.362
Education Level Degree	3.325

The analysis showed that higher monthly income was positively associated with the intention to purchase electric vehicles (EVs), highlighting income as a key factor in EV adoption. Interestingly, individuals with SPM and Diploma qualifications were more likely to intend to purchase EVs than those with postgraduate degrees. This may be due to greater awareness of EV limitations among highly educated individuals, leading to hesitancy. Age was negatively associated with EV purchase intention, indicating younger individuals are more open to adopting EVs. These findings are reflected in the odds ratios, where income (1.180), SPM (7.945), Diploma (8.362), and age (0.950) significantly influenced EV purchase likelihood.

CONCLUSION

The objective of this study is to identify the demographic factors that influence Malaysians' likelihood to purchase EVs using logistic regression. It is found that age, monthly income and education level are significant variables of EV purchase intention. The results show that as age increases, the likelihood of purchasing EVs decreases, explaining that younger individuals tend to buy EVs. The monthly income also shows that a higher monthly income was positively associated with EV purchase intentions. That shows income is pivotal in determining EVs' purchase intention in Malaysia. Interestingly, individuals with SPM and diploma qualifications were more likely to have the intention to purchase EVs compared to postgraduate levels. This is because people with a higher education level are more aware of EVs' limitations and leads to hesitation towards EV adoption

Moreover, it is also revealed that gender, number of cars owned, and weekly driving distance are not significant variables of EV purchase intention. It shows that these factors do not play a positive role in determining consumers' intention to purchase EVs. Both males and females have similar levels of interest in EV, as the variables are not significant in the model. Furthermore, the number of cars owned does not influence the purchasing intention, indicating that car ownership status is not directly linked to the desire to adopt EVs. Other than that, weekly driving distances are also not appearing as a significant variable as consumers might have concerns over battery ranges if they buy EVs. This may reflect growing consumer confidence in EV capabilities or limited awareness of range-related issues. Overall, these findings highlight that certain demographic factors are more influential than others in predicting EV adoption.

The recommendation from this study future is the future research should use a probability-based sampling technique, such as stratified or random sampling methods, to minimize sampling bias. In addition, future research should obtain extra understanding of consumers' motivations and barriers to adopting EVs. For example, by including psychological and behavioural variables such as environmental concern and technological readiness. It is recommended that future research include longitudinal or experimental designs to examine how attitudes toward EVs change across time because of government policies.

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