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The factors influencing on “made in Vietnam” electric cars demand

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ABSTRACT

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This article examines the factors affecting the demand for “Made in Vietnam” electric cars. The research results 6 main factors affecting the demand for “Made in Vietnam” electric cars including (1) Prices of “Made in Vietnam” electric cars; (2) Consumer income; (3) Consumer taste; (4) Price of related goods (including substitutes and complementary goods); (5) Market expectations for “Made in Vietnam” electric cars; (6) Policy institutions and consumers’ psychology towards environmentally friendly products. On that basis, the research team used Eviews8 software to test the impact of price factors and related commodity prices on the quantity and demand of electric cars. The results also indicate that when the price of “Made in Vietnam” electric cars increases by 1%, the quantity demanded for “Made in Vietnam” electric cars decreases by 1.39%; When income increases to 1%, consumers will be willing to save 0.26% to buy an electric car. If the price of substitute goods increases by 1%, the demand for “Made in Vietnam” electric cars will increase by 1.91%, and if the price of complementary goods increases by 1%, the demand for “Made in Vietnam” electric cars will decrease by 3.12%. From the results obtained, the research team has some recommendations to stimulate demand for “Made in Vietnam” electric cars, a product with many advantages in the green fuel era.

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1. Introduction

The number of vehicles running on fossil fuels is increasing, causing environmental pollution and serious traffic jams. Cars are still the main source of polluted gases, affecting the environment and people’s health. Faced with this situation, a series of races by major car manufacturers in the field of manufacturing vehicles powered by environmentally friendly materials is taking place (An, 2019). Vietnamese enterprises, especially VinFast, have also officially entered the market by launching Vietnam’s first commercial electric vehicle model, VFe34 (Dinh Tuyen, 2022). This is a premise for other Vietnamese car manufacturers to have the motivation to produce similar car models, especially in the context that consumers are enjoying many advantages thanks to the Government’s new regulations. At present, the development potential of electric vehicles in Vietnam is hotter than ever when gasoline prices tend to increase and fluctuate strongly, at times gasoline prices skyrocketed to more than 30 thousand VND per liter due to the impact of the international market. Many electric car manufacturing businesses want to take advantage of this moment to launch new, modern products that suit Vietnamese tastes. However, scientific research on the electric car market is quite limited in Vietnam, requiring serious and up-to-date research on this new type of vehicle. Faced with that situation, the group of authors conducted research “*Research on factors affecting demand for “Made in Vietnam” electric cars*” to synthesize information about electric cars, market trends, factors affecting the demand for “Made in Vietnam” electric cars and finding suitable directions for businesses. Therefore, propose some recommended solutions and policy implications to stimulate demand for “Made in Vietnam” electric car products in the future.

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2. Theoretical basis and research overview

2.1. Theoretical basis

The theory of demand for goods and services has been presented and applied in much scientific research works and textbooks on Microeconomics. In this study, to evaluate the factors affecting the demand for electric cars, the research team applied the theory of demand in the documents of (Anh & Duong, 2021; Huong & Duong, 2020; Duong, 2012; Doll, 2022).

Demand (D): Demand is the quantity of a good or service that buyers are able and willing to buy at different prices during a certain period (with other factors remaining unchanged).

Quantity demanded (Q^D): the quantity of goods and services that a buyer is willing or able to buy at a certain price in a certain period, under the condition that other factors do not change.

For each different type of goods, the factors affecting demand will be different. *Common factors affecting demand and quantity can include:*

Price of goods itself (P_x)

The price of the good itself is considered an endogenous variable, as mentioned above, when the price of the good itself increases, the quantity demanded of those goods decreases and vice versa (under the condition that other factors are unchanged).

$$\begin{aligned} P_x \uparrow &\Rightarrow Q_x^D \downarrow \\ P_x \downarrow &\Rightarrow Q_x^D \uparrow \end{aligned}$$

Consumer's income (I): Income indicates the spending ability of consumers; for different types of goods, the impact of income on demand for goods will be different. For normal goods, income increases, and demand for goods and services increases; for secondary goods, income increases, and demand for goods and services decreases (Hiep, 2020).

Price of related goods (Substitute and complementary goods) (P_y). When other factors remain unchanged, an increase in the price of substitute goods will cause the demand for the goods in question to increase and vice versa. If the price of complementary goods increases, the demand for the goods in question will decrease and vice versa.

Number of consumers (n). This factor reflects the market size, the more consumers in the market, the more demand increases, and vice versa.

Tastes (T). Tastes are the consumer's preferences or priorities.

Consumer expectations about income and prices (E). If consumers' future income is expected to increase, current demand will increase and vice versa. If consumers expect the price of goods to increase in the future, current demand increases and vice versa.

Other factors

It is possible to list many other factors that also affect the change in demand for a given good: (1) Government policies and regulations; (2) Effectiveness of the enterprise's advertising and product marketing campaigns; (3) Weather and climate; (4) Religion, belief, etc.

2.2. Research overview

Several empirical studies have been conducted on cars, electric cars, and the demand for some goods and products. However, there have not been many in-depth studies on the demand for electric cars, the articles only analyze from the perspective of demand for general goods or only research on the market for electric cars or cars in general. Specifically, research by Nguyen Khanh Huy (2021) pointed out 5 factors affecting the decision to buy cars in the Vietnamese market, including *Brand; Price; Design; Utilities, and Technology*. The factor that most strongly influences the decision to buy a car is *Technology*, and the factor that least influences the decision to buy a car is *Price*. Hoang (2022a,b) analyzes electric car purchase intention based on an integrated approach between the Unified Theory of Acceptance and Use of Technology Model (UTAUT) and the Norm Activation Model (NAM), accordingly, consumer intention is influenced by *performance expectancy, effort expectancy, social influence, favorable conditions, personal norms, perceived responsibility, and problem perception*. Research by Thi Van Anh et al. (2022) on factors affecting the intention to buy "Made in Vietnam" electric cars, analyze 6 factors affecting the intention to buy "Made in Vietnam" electric cars through AMOS software, SEM linear structural model: (i) *Price-cost perception*; (ii) *Subjective norms*; (iii) *Expected effectiveness*; (iv) *Environmental awareness*; (v) *Impact from the government*; (vi) *Favorable conditions*. The group's research results showed that Vietnamese consumers' intention to buy Made in Vietnam electric cars

is influenced by 5 factors arranged in order from the factor with the most to the lowest impact including: (1) Expected effectiveness (+ 0.576); (2) Impact from the government (+ 0.468); (3) Price – cost perception (0.439); (4) Environmental awareness (+ 0.395); (5) Favorable conditions (+ 0.296); factor “Subjective norms” There is not enough statistically significant basis to confirm that it has an impact on the intention to buy Made in Vietnam electric cars. According to Le Dinh Nghiem (2022), Electric vehicles in Vietnam are quite new, and the production of electric vehicles has not received adequate investment attention. Up to now, Vietnam only has an official Vietnamese automobile factory (Vin Fast Cars manufacturing factory). Electric vehicles in Vietnam are still in their infancy and need to put in a lot of effort to affirm their position in the region and reach out to the whole world. Research by Sriram et al. (2022) identifies factors that can influence consumers’ intention to use electric vehicles. A quantitative method was applied, and data was collected from 172 respondents through an online survey method using a convenience sampling method. An effective statistical method, exploratory factor analysis, was performed using IBM SPSS 23 to identify the factors. Research has identified the following factors: *Financial barriers; Vehicle performance barriers; Lack of charging infrastructure; Environmental conservation; Social influence; and social awareness of electric vehicles* are factors affecting the use of electric vehicles. The results of the study help policymakers revise current policies towards electric vehicles in emerging countries (Huyen, 2019; Lambert, 2021).

Some studies focus on analyzing factors affecting the demand for goods and services, including electric cars. In the research of Van Anh et al. (2022) on dry hand sanitizer demand. By synthesizing and analyzing survey data, it shows that the demand for dry hand sanitizer products among students is influenced by many factors, in which, *disease factors, and the price of dry hand sanitizer* factor play the most important role. Van Anh et al. (2022) analyzed the factors affecting the demand for “Made in Vietnam” facial cleanser among Vietnamese young people, including *product price, income, tastes, related commodity prices, market expectations*. According to Smithers (2019), 6 factors stimulating the demand for electric vehicles includes: (1) *Urbanization*; (2) *Pollution and congestion regulations*; (3) *The growing popularity of charging stations*; (4) *Improved battery technology*; (5) *More options*; (6) *Market trend*.

3. Research methodology

3.1 Desk research methodology

The research team carried out desk research to clarify the theoretical basis of demand and factors affecting the demand for “Made in Vietnam” electric cars. This article reviews studies on Demand for goods and services and studies on electric cars through an academic database system including Researchgate, Science Direct, IEE Explore, Scopus, Emerald, Insight, Taylor & Francis Online In addition, there is the Google Scholar search engine and information pages about electric vehicles in general and electric bicycles in particular. From there, the group identified factors affecting the demand for “Made in Vietnam” electric cars and made specific conclusions about the level of influence of each factor.

3.1 Practical research methods

Based on the factors affecting the demand for electric cars, the research team developed a survey questionnaire. After completing the survey, a pilot survey was conducted with 10 people who were knowledgeable about electric cars. The comments of individuals who are knowledgeable about cars are the basis to help the research team complete the official survey form. The official survey questionnaire was purposefully conducted by the research team, sending the complete survey link to employees at businesses and groups related to electric cars on social networks such as Facebook, Zalo, email. The form is designed on the Google Form platform with the link. Of the 269 survey participants, 212 knew about “Made in Vietnam” electric cars (78.8%), 57 people had never heard of them (21.2%), although the survey was purposefully aimed at people who are knowledgeable about cars, however, due to the survey on the Google Form platform, the number of votes collected still included people who did not know about cars. When creating the survey questionnaire, the research team identified this situation, with these people not participating in examining the influence of factors. With 212 people who knew about “Made in Vietnam” electric cars, the survey continued to learn about their understanding of the product and consider the influence of factors on their willingness and ability to buy “Made in Vietnam” electric cars, research data after being collected will be cleaned and analyzed with the support of Eviews8 software. Based on the influencing factors, combined with the demand analysis method according to the econometric model, the research team conducted an estimate of the demand for “Made in Vietnam” electric cars. Cụ thể: With 2 factors: Price (P), Prices of related goods including prices of substitute goods (PTT), and prices of complementary goods (PBS), The research team will build a regression equation to build the relationship between these factors and demand, and demand for “Made in Vietnam” electric cars.

General model:

$$Q = a \times P + b \quad (1)$$

In which: P is the price of “Made in Vietnam” electric cars; Q is the quantity demanded of “Made in Vietnam” electric cars (*demonstrates the survey subjects’ willingness and ability to pay*). a, b are the coefficients.

$$QSS_{TT} = c \times P_{TT} + d \quad (2)$$

In which: P_{TT} is the price of substitute goods of “Made in Vietnam” electric cars (*The price of a car powered by a gasoline or diesel engine is a substitute for a “Made in Vietnam” electric car*); QSS_{TT} is the quantity demanded of “Made in Vietnam”

electric cars (*demonstrates the survey subjects' willingness and ability to pay when there is a change in the price of substitute goods*). are the coefficients.

$$QSS_{BS} = e \times P_{BS} + f \quad (3)$$

Which: P_{BS} is the price of complementary goods of "Made in Vietnam" electric cars (*The price of the battery is the price of complementary goods of "Made in Vietnam" electric cars*); QSS_{BS} is the quantity demanded of "Made in Vietnam" electric cars (*demonstrates the survey subjects' willingness and ability to pay when there is a change in the price of complementary goods*). e and f are the coefficients.

To build linear regression models to test factors affecting the demand for "Made in Vietnam" electric cars, the research team performed quantitative analysis steps according to Nguyen Quang Dong, and Nguyen Thi Minh (2013) as follows:

Step 1: Use Eviews 8 software to run the model with collected secondary data.

Step 2: Check the statistical significance of the regression coefficients with the explanatory variables and the statistical significance of the regression model with significance level $\alpha=0.05$.

A regression coefficient is statistically significant if:

- Prob < $\alpha=0.05$
- Prob(F-statistic) < $\alpha=0.05$

Step 3: Check the explainability of the model through the coefficients R^2 and Adjusted R^2 .

A model is explanatory (fit) if:

- $R^2 > 0.6$
- Adjusted $R^2 > 0.6$

Step 4: Check the model's defects with $\alpha=0.05$.

A model is good (*can be used for analysis*) when the regression coefficients in the model are statistically significant, and the R-squared and adjusted R-squared should not have autocorrelation and heteroskedasticity. At the same time, the residuals of the model should follow the standard normal distribution.

In the study, the authors used tools on Eviews 8 to check for these defects. Specifically:

- Breusch-Godfrey test to check autocorrelation. The model does not have an autocorrelation defect at some level p if Prob (F-statistic) and Prob (Obs \times R-squared) > $\alpha=0.05$.
- Breusch-Pagan-Godfrey to test heteroskedasticity. The model is not subject to heteroskedasticity if Prob (F-statistic) and Prob (Obs \times Chi-squared) > $\alpha=0.05$.
- Jarque-Bera to check if the residuals of the model follow the standard normal distribution. The residuals of the model are normally distributed if Prob (Jarque - Bera) > 0.05.

When the above conditions are satisfied, the model results are estimated and analyzed.

4. Research Results

4.1. Situation of using/owning "Made in Vietnam" electric cars

Analysis of demand for "Made in Vietnam" electric cars is carried out through consumer opinion surveys. Level of knowledge of "Made in Vietnam" electric car products among Vietnamese consumers has been shown in Fig. 1

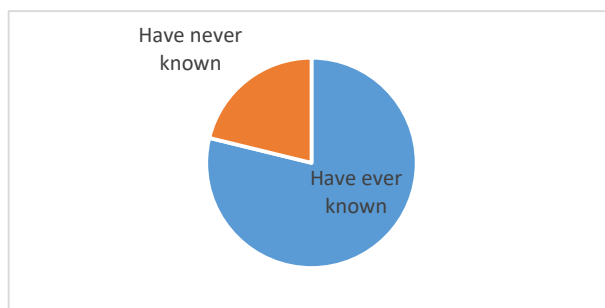


Fig. 1. Level of knowledge of "Made in Vietnam" electric car products among Vietnamese consumers
Source: The survey results

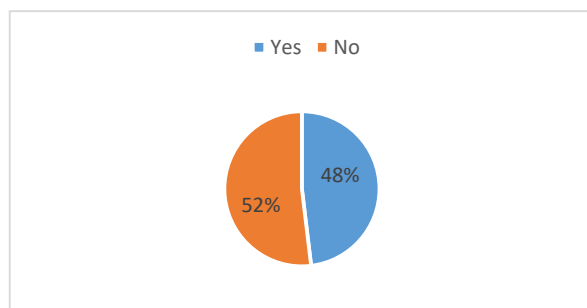


Fig. 2. Rate of using/owning "Made in Vietnam" electric cars among survey subjects

Of the 269 survey participants, 212 knew about “Made in Vietnam” electric cars (78.8%); 57 people never knew about them (21.2%). Of the 212 people who know about “Made in Vietnam” electric cars, the proportion of people who have used/owned the car is nearly 50%. The rate of using/owning “Made in Vietnam” electric cars among survey subjects has been shown in Fig. 2. Of the 212 people who know about “Made in Vietnam” electric cars, there are 102 people who use/own the product (48.1%), and 110 people who do not use/own the product (51.9%). In addition, out of 110 people who do not use/own the product, when asked about consumers’ wishes on whether they want to use/own a “Made in Vietnam” electric car in the future, there are 81 people want to use/own (73.6%) and 29 people have no desire (26.4%). The rate of desire to use/own a “Made in Vietnam” electric car for those who have not used/owned the product has been shown in Fig. 3.

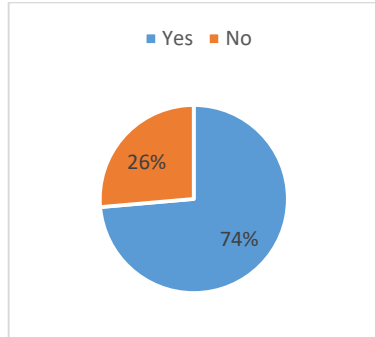


Fig. 3. Desire to use/own a “Made in Vietnam” electric car for those who have not used/owned the product.

Source: The survey results

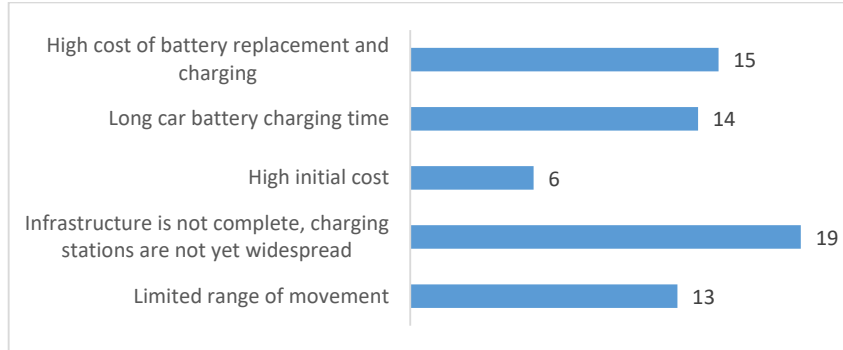


Fig. 4. Reasons for not using/owning electric car products “Made in Vietnam”

Regarding consumer trust/support for “Made in Vietnam” electric cars, out of 212 survey participants, the majority showed support and trust (94.8%) for the product. The research team surveyed 110/212 people who do not use/own “Made in Vietnam” electric cars. When asked about their desire to use/own “Made in Vietnam” electric cars, there were 29 people not interested (26.4%). The reasons for not wanting to use the product are noted in Fig. 4. For 29 respondents who do not want to use/own electric car products “Made in Vietnam”, the reason chosen by many surveyors is that the infrastructure is currently incomplete and charging stations are not yet widespread, followed by high battery replacement and charging costs, long battery charging time, limited travel range and high initial cost are the reasons mentioned. These are also current challenges facing “Made in Vietnam” electric car manufacturers.

4.2. Analysis of factors affecting the demand for “Made in Vietnam” electric cars.

4.2.1. Price factors for “Made in Vietnam” electric cars.

To consider the impact of the price factor of “Made in Vietnam” electric cars, the research team examined the willingness and ability to pay for a “Made in Vietnam” electric car at different prices. This item ranges from 400,000,000 to 1,200,000,000 VND. The survey results are shown in Table 1.

Table 1

The relationship between price and willingness and ability to pay to buy “Made in Vietnam” electric cars

P - Price (million VND)	Q - Willing and able to pay	Unwilling
450	155	57
550	129	83
650	111	101
750	90	122
850	66	146
950	51	161
1050	40	172
1150	38	174

Source: The survey results

To find the cause-and-effect relationship between the price of “Made in Vietnam” electric cars (P) and the number of cars that buyers are willing and able to buy (Q), the research team used Eview8 software. The estimation results are shown in Table 2.

Table 2

Results of estimating the relationship between price (P) and quantity demanded of “Made in Vietnam” electric cars (Q)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
P	-0.174762	0.013518	-12.92836	0.0000
C	224.8095	11.24898	19.98488	0.0000
R-squared	0.965346 Mean dependent var			85.00000
Adjusted R-squared	0.959571 S.D. dependent var			43.56932
S.E. of regression	8.760481 Akaike info criterion			7.390697
Sum squared resid	460.4762 Schwarz criterion			7.410557
Log-likelihood	-27.56279 Hannan-Quinn criteria.			7.256746
F-statistic	167.1425 Durbin-Watson stat			0.902310
Prob(F-statistic)	0.000013			

Source: Estimated results

From the estimation results, we see that there is an inverse relationship between price and demand for “Made in Vietnam” electric cars, specifically the relationship between P and demand (Q) is expressed by the following equation:

$$Q = -0.174762 P + 224.8095$$

Through the constructed price demand function equation, we can calculate the price elasticity of demand:

$$Q_P^D = -0.174762$$

In the considered price range of 450 - 1150 million VND, the quantity demanded decreases from 155 – 38

$$E_P^D = [(38-155)/(38+155)] / [(1150-450)/(1150+450)] = - 1.39$$

This shows that, in the price range of 450 - 1150 million VND, when the price of “Made in Vietnam” electric cars increases by 1%, the quantity demanded of “Made in Vietnam” electric cars decreases by 1.39%.

Check model fit

- + The coefficients are all statistically significant because the coefficient Prob (P)=0.0000 < 0.05; Prob (C)=0.0000 < 0.05
- + The regression model is suitable because Prob coefficient (F-statistic) = 0.000013 < 0.05
- + The coefficient of determination R-squared and Adjusted R-squared is 0.965346 respectively; 0.959571 > 0.6

Check for autocorrelation defects, the results are given in Table 3.

Table 3**Check for autocorrelation defects.**

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.823830	Prob. F(2,4)	0.5016
Obs*R-squared	2.333937	Prob. Chi-Square (2)	0.3113

Source: Model testing results

According to Table 3, the values of Prob. F and Prob. Chi-Square are all > 0.05. The model does not have autocorrelation defects. To check the heteroskedasticity, we present the results in Table 4.

Table 4

Heteroskedasticity Test: White

F-statistic	2.111186	Prob. F(2,5)	0.2164
Obs*R-squared	3.662721	Prob. Chi-Square (2)	0.1602
Scaled explained SS	1.353475	Prob. Chi-Square (2)	0.5083

Source: Model testing results

According to Table 4, the values of Prob. F and Prob. Chi-Square are all > 0.05. The model does not have heteroskedasticity errors.

The residuals of the model follow a normal distribution, with Prob (Jarque-Bera) values in the model > 0.05 (Fig. 5).

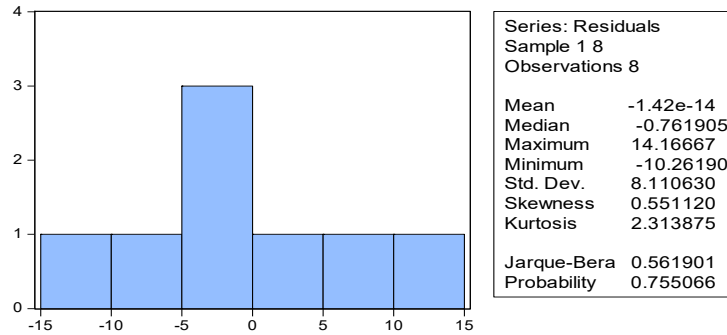


Fig. 5. Normally distributed residuals

Source: Model testing results

4.2.2. The consumer's income factor

To study the impact of income factors on consumers' willingness and ability to pay, the research team collected information on the income of survey participants. At the same time, consider the amount of money consumers are willing to spend to buy an electric car and determine the income elasticity of savings. The income of survey participants has been shown in Fig. 6.

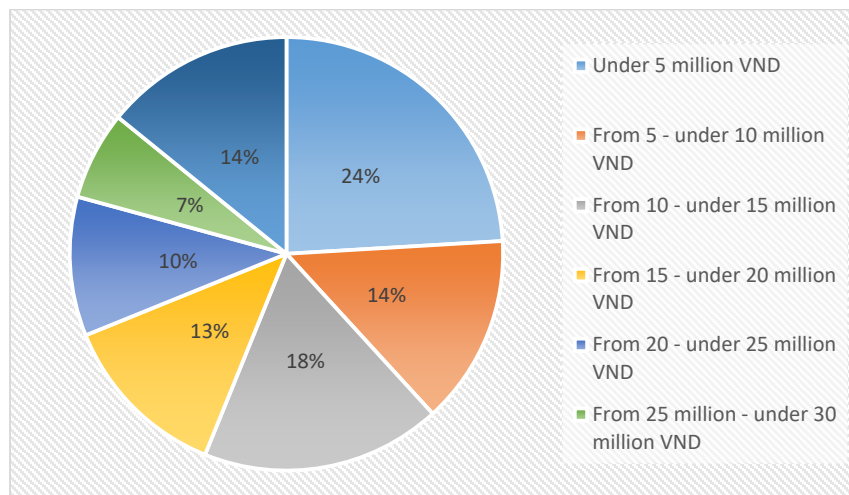


Fig. 6. Income of survey participants

Source: The survey results

Regarding the income of 212 people who know about “Made in Vietnam” electric cars, 51 people have an income of under 5 million VND (24.1%), 30 people have an income of 5 - 10 million VND (14.2%), 38 people have income from 10 - 15 million VND (17.9%), 27 people have income from 15 - 20 million VND (12.7%), 22 people have income from 20 - 25 million VND (10.4%), 14 people have income from 25 - 30 million VND (6.6%), 30 people have income over 30 million VND (14.2%). (Fig. 7).

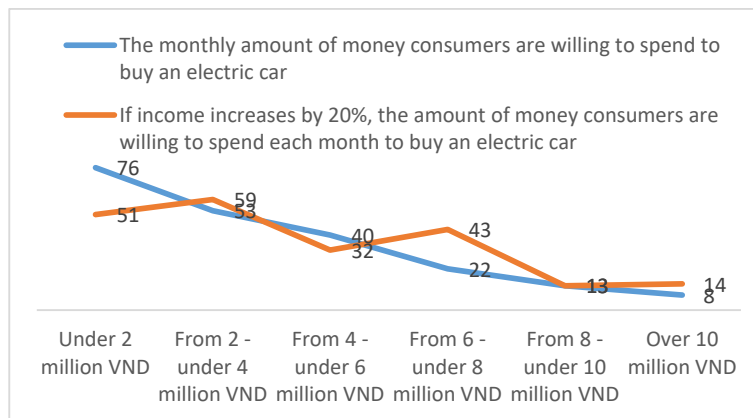


Fig. 7. Amount of money willing to save to buy an electric car

With 212 survey participants, it shows that as income increases, consumers are willing to save more money to buy “Made in Vietnam” electric cars. When income increases by 20%, the number of people willing to spend their income on savings to buy an electric car will follow the trend of the number of people saving at a larger level increasing. This shows that as income increases, consumers are willing to save at higher levels to buy “Made in Vietnam” electric cars. Data show that the average income of survey participants is 14.88 million VND, and the amount of money ready to accumulate to buy an electric car is 3.75 million VND. When income increases by 20%, the amount of money willing to buy an electric car is 4.53 million VND.

$$\Delta S/\Delta I = (5,53-3,75)/0,2 \times 14,88 = 0,26$$

It shows that when income increases by 1 million VND, the participants are willing to spend 260 thousand VND to buy electric cars.

4.2.3. Consumers' tastes factor

According to current research, in the current electric car market, there are 4 main types of electric cars:

(1). Battery-powered Electric Vehicle (BEV): is an electric vehicle powered entirely by batteries, the vehicle's structure does not include a gasoline engine or fuel injector. The power of this vehicle is stored in a rechargeable battery and is charged from an external source or regenerative braking right inside the vehicle.

(2). Hybrid Electric Vehicles (HEV): a type of car that uses a combination of an electric motor and an internal combustion engine. When running slowly (average below 30km/h), the electric motor will operate, but when accelerating, the electric motor only plays a supporting role for the traditional engine.

(3). Plug-in Hybrid Electric Vehicles (PHEV): is a hybrid between electric cars and regular cars like HEV.

(4). Fuel Cell Electric Vehicle (FCEV): is an electric vehicle that uses fuel cells to operate to help convert hydrogen gas into electricity to power machinery.

Survey results of 212 people with knowledge about “Made in Vietnam” electric cars show that the preferred car type and consumer desire for “Made in Vietnam” electric cars are shown in Fig. 8.

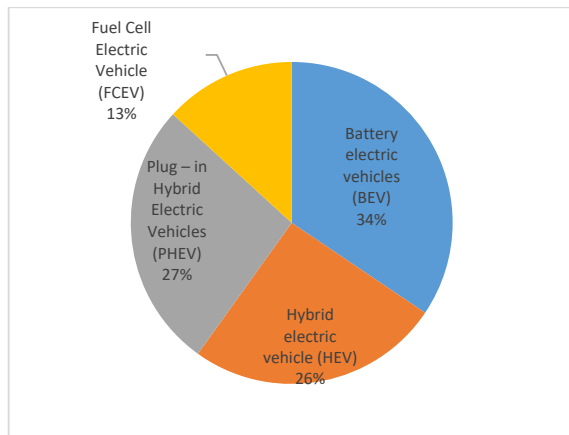


Fig. 8. Preferred Electric Cars

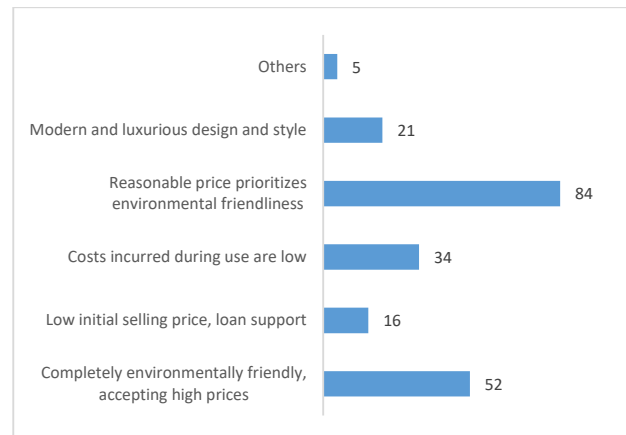


Fig. 9. The kind of electric car those consumers want

Source: The survey results

Battery electric vehicles (BEV) are preferred by 73 people (34.4%); Hybrid electric vehicle (HEV) preferred by 54 people (25.5%); Plug-in Hybrid Electric Vehicles (PHEV) preferred by 57 people (26.9%); Fuel Cell Electric Vehicle (FCEV) preferred by 28 people (13.2%). The kind of electric car those consumers want to have been shown in Fig. 9. When surveying the type of electric car that consumers want, 84 people (39.6%) want a reasonable price to prioritize eco-friendly; 52 people (24.5%) want the product to be completely environmentally friendly, accepting the high price; 34 people (16%) want costs incurred during use to be low; 21 people (9.9%) want modern and luxurious designs and styles; 16 people (7.5%) want a low initial price and loan support; some other opinions show that they want the product to be durable, run for a long time and fuel quickly.

4.4. Related goods price factors

❖ Price of substitute goods

On the market, the cars that can replace “Made in Vietnam” electric cars are cars that run on gasoline or diesel engines. Although these vehicles have concerns about causing environmental pollution, operating costs when gasoline prices increase...

However, using/owning this vehicle still ensures convenience during travel, and convenience during use. The top 5 best-selling car lines in Vietnam such as Hyundai Accent, Toyota Veloz Cross, Mitsubishi, Toyota Vios, and Hyundai Creta... in the C-class segment have prices ranging from 400 - 900 million VND, considered substitute goods of “Made in Vietnam” electric cars. Survey results documenting the impact of substitute goods prices on the demand for “Made in Vietnam” electric cars are shown in Fig. 10.

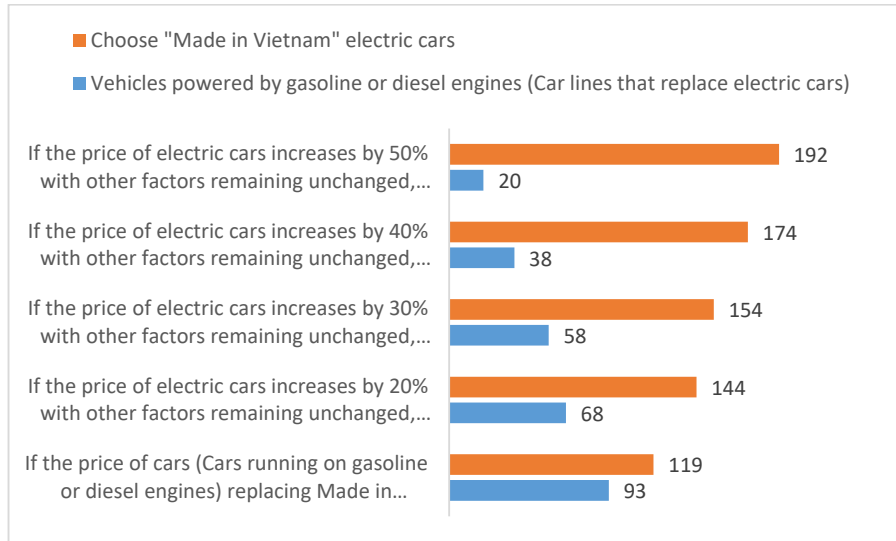


Fig. 10. Impact on the price of substitute goods on the demand for “Made in Vietnam” electric cars

Source: The survey results

If the price of cars (Cars running on gasoline or diesel engines) replacing “Made in Vietnam” electric cars increases by 10% with other factors remaining unchanged, 93 people choose cars running on gasoline or diesel engines 119 people choose “Made in Vietnam” electric cars.

If the price of cars (Cars running on gasoline or diesel engines) replacing “Made in Vietnam” electric cars increases by 20% with other factors remaining unchanged, 68 people choose cars running on gasoline or diesel engines 144 people choose “Made in Vietnam” electric cars.

If the price of cars (Cars running on gasoline or diesel engines) replacing “Made in Vietnam” electric cars increases by 30% with other factors remaining unchanged, 58 people choose cars running on gasoline or diesel engines 154 people choose “Made in Vietnam” electric cars.

If the price of cars (Cars running on gasoline or diesel engines) replacing “Made in Vietnam” electric cars increases by 40% with other factors remaining unchanged, 38 people choose cars running on gasoline or diesel engines 174 people choose “Made in Vietnam” electric cars.

If the price of cars (Cars running on gasoline or diesel engines) replacing “Made in Vietnam” electric cars increases by 50% with other factors remaining unchanged, 20 people choose cars running on gasoline or diesel engines 192 people choose “Made in Vietnam” electric cars.

We have a table showing the relationship between the price of substitute goods (taking the average price of the price range of 400-900 million VND as the starting price) and the demand for “Made in Vietnam” electric cars as shown in Table 5.

Table 5
Relationship between replacement prices and choice of “Made in Vietnam” electric cars

P_{IT} - Price (million VND)	Q – Choosing “Made in Vietnam” electric cars
715	119
780	144
845	154
910	174
975	192

Source: The survey results

Thus, *When the price of cars powered by gasoline or diesel engines, substitutes for “Made in Vietnam” electric cars, increases, the number of electric cars that consumers are willing and able to buy increases.* (consistent with demand theory).

Table 6

Results of estimating the relationship between P substitute goods and demand for “Made in Vietnam” electric cars

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PTT	0.270769	0.017223	15.72097	0.0006
C	-72.20000	14.63967	-4.931804	0.0160
R-squared	0.988007	Mean dependent var		156.6000
Adjusted R-squared	0.984010	S.D. dependent var		27.99643
S.E. of regression	3.540245	Akaike info criterion		5.655443
Sum squared resid	37.60000	Schwarz criterion		5.499218
Log-likelihood	-12.13861	Hannan-Quinn criteria.		5.236151
F-statistic	247.1489	Durbin-Watson stat		3.150000
Prob(F-statistic)	0.000559			

Source: Estimated results

From the estimation results, we see that the price of substitute goods (PTT) and the demand for “Made in Vietnam” electric cars (QSS_{TT}) have a *positive relationship* (consistent with theory), Specifically, the relationship between the price of substitute goods (PTT) and the quantity of demand for “Made in Vietnam” electric cars (quantity of choosing “Made in Vietnam” electric cars) ($QSSTT$) is expressed by the following equation:

$$QSS_{TT} = 0.270769P_{TT} - 72.2$$

In the price range of substitute products considered from 715 - 915 million VND, the demand (amount of choice) for “Made in Vietnam” electric cars increases from 119-192, we have:

$$E^D_{PTT} = [(192-119)/(192+119)] / [(915-715)/(915+715)] = 1.91$$

That shows that when the price of substitute goods increases by 1%, the demand for “Made in Vietnam” electric cars will increase by 1.91%.

Check model fit

- + The coefficients are all statistically significant because the coefficient Prob (P)=0.0006 < 0.05; Prob (C)=0.0160 < 0.05
- + The regression model is suitable because Prob coefficient (F-statistic) = 0.000559 < 0.05
- + The coefficient of determination R-squared and Adjusted R-squared are respectively 0.988007; 0.984010 > 0.6

Check for autocorrelation defects, the results are given in Table 7.

Table 7

Check for autocorrelation defects

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.700876	Prob. F(2,1)	0.6453
Obs*R-squared	2.918187	Prob. Chi-Square.(2)	0.2324

Source: Model testing results

According to Table 7, the values of Prob. F and Prob. Chi-Square are all > 0.05. The model does not have autocorrelation defects.

Check the heteroskedasticity, the results are given in Table 8.

Table 8

Heteroskedasticity Test: White

F-statistic	0.779058	Prob. F(2,2)	0.5621
Obs*R-squared	2.189524	Prob. Chi-Square(2)	0.3346
Scaled explained SS	0.586988	Prob. Chi-Square(2)	0.7457

Source: Model testing results

According to Table 8, the values of Prob. F and Prob. Chi-Square are all > 0.05. The model does not have heteroskedasticity errors.

The residuals of the model follow a normal distribution, with Prob (Jarque-Bera) values in the model > 0.05. (Fig. 11).

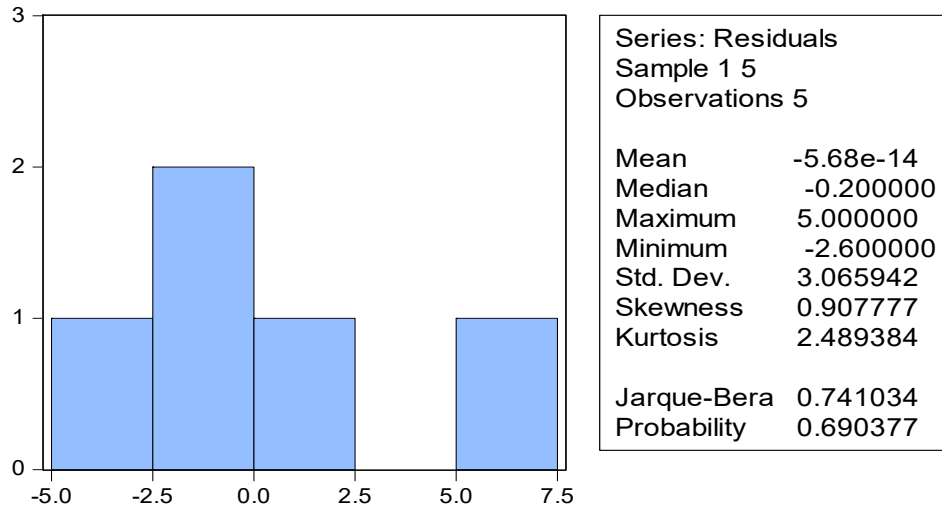


Fig. 11. Normally distributed residuals

Source: Model testing results

Prices of complementary goods

Electric cars source energy from batteries, the current battery rental price is about 1,200,000 VND/month with a limit of <1,400km/month. Batteries in this case are complementary goods of electric cars. The impact of complementary goods prices on the demand for “Made in Vietnam” electric cars is noted in Fig. 12.

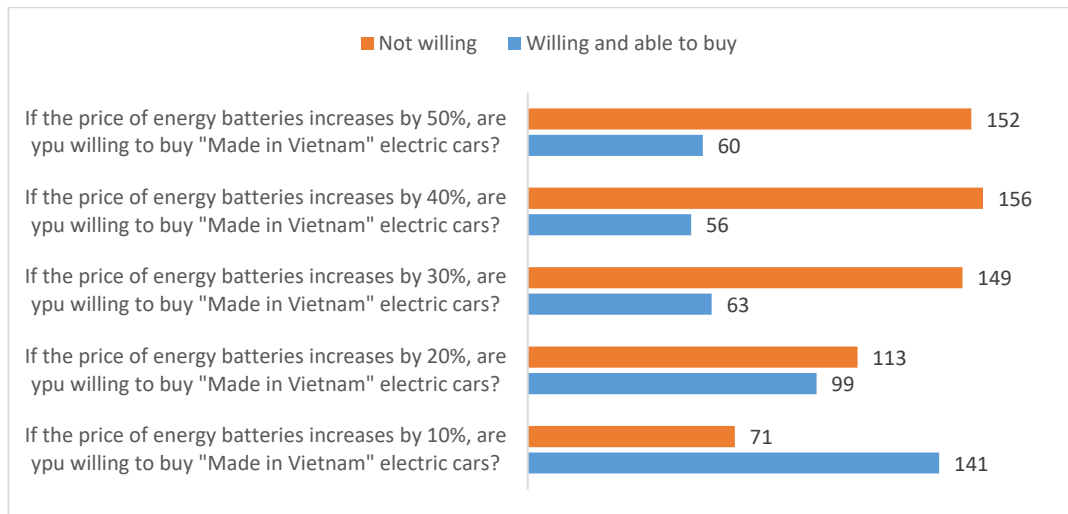


Fig. 12. Impact on the price of complementary goods on the Demand for “Made in Vietnam” electric cars

Source: The survey results

Electric cars source energy from batteries, the current battery rental price is about 1,200,000 VND/month with a limit of <1,400km/month. If the price of energy batteries increases by 10%, 141 consumers are still willing and able to buy (71 are not willing); If the price of energy batteries increases by 20%, 99 consumers are still willing and able to buy (113 are not willing); If the price of energy batteries increases by 30%, 63 consumers are still willing and able to buy (149 are not willing); If the price of energy batteries increases by 40%, 56 consumers are still willing and able to buy (156 are not willing); If the price of energy batteries increases by 50%, 60 consumers are still willing and able to buy (152 are not willing). Thus, As the price of complementary goods increases, survey results show that willingness and ability to buy (demand for “Made in Vietnam” electric cars) decreases, this is consistent with demand theory.

We have Table 9 shows the relationship between the price of complementary goods and the initial battery price of 1.2 million VND and the demand for “Made in Vietnam” electric cars.

Table 9

The relationship between the price of complementary goods (battery price) and the choice of “Made in Vietnam” electric cars

PBS - Price (million VND)	Q – Choosing “Made in Vietnam” electric cars
1,32	171
1,44	99
1,56	63
1,68	56
1,8	60

Source: The survey results

The estimate relationship between P complementary goods and demand for “Made in Vietnam” electric cars have been shown in Table 10

Table 10

Results of estimating the relationship between P complementary goods and demand for “Made in Vietnam” electric cars

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PBS	-0.170833	0.049821	-3.428912	0.0416
C	350.3000	78.17998	4.480686	0.0207
R-squared	0.796713	Mean dependent var		83.80000
Adjusted R-squared	0.728950	S.D. dependent var		36.31391
S.E. of regression	18.90591	Akaike info criterion		9.006000
Sum squared resid	1072.300	Schwarz criterion		8.849775
Log-likelihood	-20.51500	Hannan-Quinn criteria.		8.586708
F-statistic	11.75744	Durbin-Watson stat		1.384874
Prob(F-statistic)	0.041571			

Source: Estimated results

From the estimation results, we see that there is an inverse relationship between the price of complementary goods (PBS) and the demand for “Made in Vietnam” electric cars (QSS_{BS}) (*consistent with theory*), specifically, the relationship between PBS and QSS_{BS} is expressed by the following equation:

$$QSS_{BS} = -0.170833 P_{BS} + 350.3000$$

In the price range of complementary goods (battery price) considered from 1.32 - 1.8 million VND, the quantity demanded (amount of choice) of “Made in Vietnam” electric cars decreases from 171-60, we have equation as follow

$$E^D_{PBS} = [(60-171)/(60+171)] / [(1,8-1,32)/(1,8+1,32)] = - 3,12$$

That shows that when the price of complementary goods increases by 1%, the demand for “Made in Vietnam” electric cars will decrease by 3.12%.

Check model fit

- + The coefficients are all statistically significant because the coefficient Prob (P)=0.0416 < 0.05; Prob (C)=0.0207 < 0.05
- + The regression model is suitable, due to the coefficient Prob (F-statistic) = 0.041571 < 0.05
- + Determination coefficient R-squared and Adjusted R-squared are respectively 0.796713; 0.728950 > 0.6

Check for autocorrelation defects, the results are given in Table 11.

Table 11

Check for autocorrelation defects

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	2.736165	Prob. F(2,1)	0.3931
Obs*R-squared	4.227481	Prob. Chi-Square(2)	0.1208

Source: Model testing results

According to Table 11, the values of Prob. F and Prob. Chi-Square are all > 0.05. The model does not have autocorrelation defects.

Check the heteroskedasticity, the results are given in Table 12.

Table 12

Heteroskedasticity Test: White

F-statistic	0.025438	Prob. F(2,2)	0.9752
Obs*R-squared	0.124033	Prob. Chi-Square(2)	0.9399
Scaled explained SS	0.011382	Prob. Chi-Square(2)	0.9943

Source: Model testing results

According to Table 12, the values of Prob. F and Prob. Chi-Square are all > 0.05. The model does not have heteroskedasticity errors. The residuals of the model follow a normal distribution, Prob (Jarque-Bera) values in the model > 0.05 (Fig. 13)

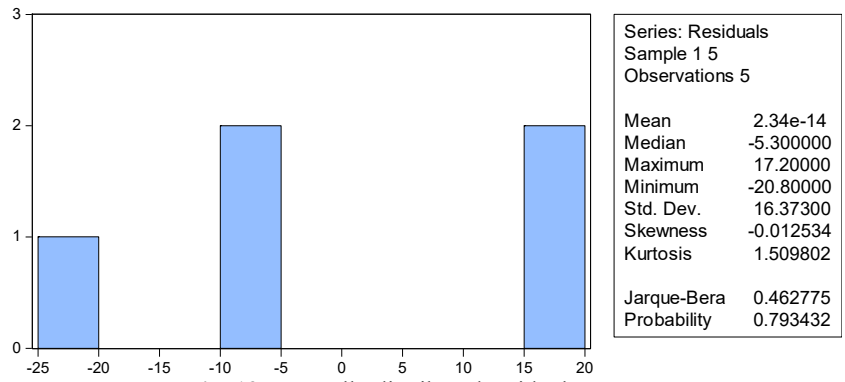


Fig. 13. Normally distributed residuals

Source: Model testing results

4.2.5. Factors in market expectations for “Made in Vietnam” electric cars

Regarding consumer expectations for “Made in Vietnam” electric cars, the survey results have been shown in Fig. 14.

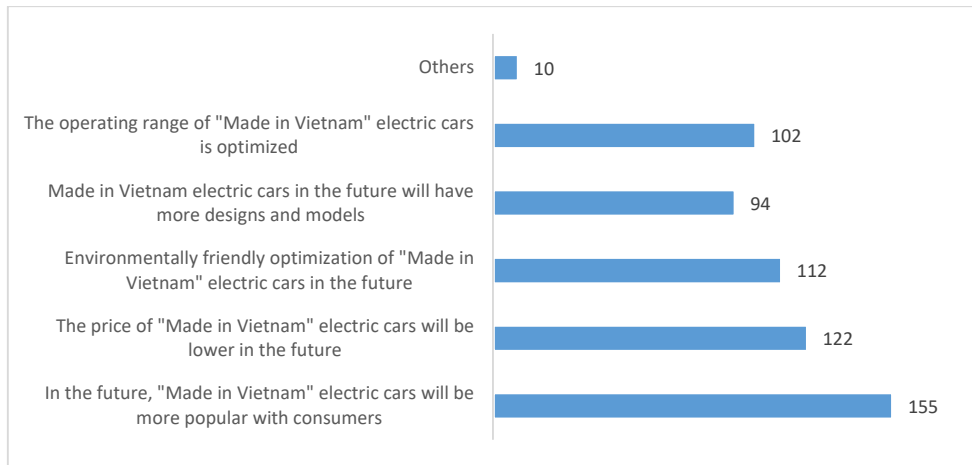


Fig. 14. Consumer expectations with “Made in Vietnam” electric cars

Source: The survey results

With 212 survey participants asked about expectations for changes in “Made in Vietnam” electric car products, the results showed that 155 people (73.1%) expected “Made in Vietnam” electric cars in the future will be more popular with consumers; 122 people (57.5%) expect the price of “Made in Vietnam” electric cars to be lower in the future; 112 people (52.8%) want to optimize environmental friendliness with “Made in Vietnam” electric cars in the future; 102 people (48.1%) want the operating range of “Made in Vietnam” electric cars to be optimized; 94 people (44.3%) want to have more designs and models of electric cars in the future; In addition, there are some other expectations about the product such as reduced charging time, sustainable development of “Made in Vietnam” electric car companies.

4.2.6. Institutional factors, policies, and consumer psychology towards environmentally friendly products

In recent years, Vietnam has had many guidelines and policies on developing the automobile industry, especially encouraging the development of low- or no-emission means of transport. It can be seen that support policies for the electric vehicle industry in Vietnam have been initially developed and implemented, based on a system of existing regulations and policies for vehicles using internal combustion engines. In particular, with incentives on special consumption tax and registration fees, consumers can reduce a large amount of costs when buying electric cars. For manufacturers, tax incentives encourage businesses to increase investment in the field of manufacturing and assembling battery-powered electric cars. Among them, electric car manufacturer Vinfast is the business that benefits. (Le Vu, 2023)

The article by Nguyen Thi Van Anh, Hoang Thanh Tung, Chu Quoc Hung, and Nguyen Dai Nhat Minh (2022) shows the factor “Impact from the government” has a positive impact on consumer's intention to buy electric cars with an impact level

of + 0.468, ranked 2nd among the factors included in the study on factors affecting the intention to buy “Made in Vietnam” electric cars. When encouragement from the government increases by 1 unit, consumers’ intention to buy “Made in Vietnam” electric cars will change in the same direction by 0.468 units. Therefore, the government should have more environmental communication campaigns; Communication campaign “Vietnamese people prioritize using Vietnamese products”; The government should take action to reduce taxes and fees on electric cars... In addition, the Government needs to have more preferential policies for Vietnamese electric cars. Regarding consumers’ tendency to use environmentally friendly products, with 212 survey participants, the research team collected information about the advantages of “Made in Vietnam” electric cars. The results also recorded the number of people who said that *electric cars are eco – friendly 187 people (88,2%)*, next, 136 people (64.2%) said that the car does not make noise due to the engine, and 106 people (50%) think the car has many modern features, Vehicle maintenance costs are lower than gasoline cars for 76 people (35.8%), high safety for 64 people (30.2%), high speed for 28 people (13.2%), and some other opinions for that competitive prices, fashionable designs (Fig. 15).

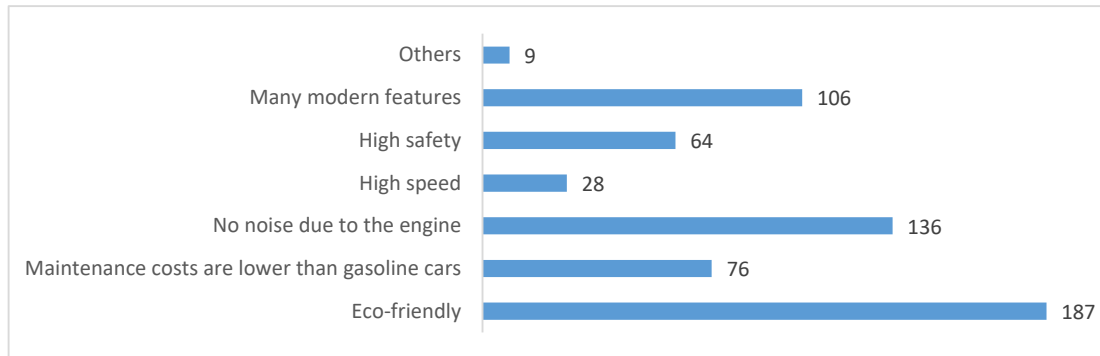


Fig. 15. Advantages of “Made in Vietnam” electric cars

Source: The survey results

Thus, it can be seen that the trend of consumers choosing to use “Made in Vietnam” electric cars as an environmentally friendly product is very high. In the future, this trend will be maintained and increase further with propaganda and encouragement activities for environmental protection by state agencies and businesses. This is a huge advantage for the “Made in Vietnam” electric car manufacturing industry.

5. Recommendations

First, With the Government’s incentives, companies want to boost car sales, **necessary to have a stable supply of parts and accessories, especially the supply of semiconductors**. To do that, businesses need to expand cooperation with many suppliers to minimize the risk of product shortages. Some chip suppliers include Nvidia, Samsung Electronics, and Intel... When the supply of goods is stable, it is necessary to consider logistics so that the components arrive at the factory quickly and sufficiently. Businesses also need to store a certain number of raw materials in warehouses to minimize risks due to disruptions in the global supply chain. Only then can businesses take advantage of being at the forefront, confidently reduce costs, and increase sales.

Second, **Car manufacturers need to pay special attention to marketing**. Frost & Sullivan’s survey also shows that Vietnamese people’s interest in electric car technology overcomes limitations such as price, or concerns about safety (Siebring & Tan, 2018; Hai, 2021). Marketing campaigns must stimulate users’ interest in the self-driving technology of electric cars, low operating costs, and make drivers feel secure when traveling long distances: VinFast’s fast charging port allows the electric car to travel about 180km after only about 18 minutes of charging (Tra, 2021). Along with that, companies also need to speed up the process of installing charging stations, especially in suburban areas and on highways...

Third, With the “Made in Vietnam” electric car product, customers are in the “Brand awareness” stage. Therefore, for manufacturing businesses and distribution channels, the most important task for them at this time is **Making customers remember your brand** when talking about electric cars. To do that, businesses need to draw customer portraits and create advertising content to solve customer problems.

Fourth, solutions related to **Taking advantage of “advantages” and overcoming “disadvantages”** of “Made in Vietnam” electric cars, most consumers do not have confidence in the safety of electric cars produced in Vietnam. The Vinfast VFe34 electric car line has been tested to meet EURO NCAP safety standards with 5/5 stars for the high-end version (Vinfast, 2021), Not inferior to other high-end car models from abroad such as Land Rover Defender 2020 and Isuzu D-MAX (EURO NCAP, 2018). What needs to be done for manufacturers is **to put their products through more tests**, At the same time, run content advertising campaigns **“Vietnamese domestic cars pass all safety tests”**. In addition, one of the issues consumers worry about most when using electric cars is still about energy supply. To solve the above problem, there is no other way, domestic manufacturers like Vinfast should **develop battery/battery technology to help vehicles go farther**. In addition, manufacturers

can also offer consumers many battery/battery choices and prices to meet consumers' needs for long-distance or short-distance travel.

It can be said that "Made in Vietnam" electric cars receive special attention from consumers regarding environmental issues (Outstanding technical, safety, and technology factors). To take advantage of this, car companies should *develop both software and hardware to improve vehicle energy* to solve many customer problems at the same time: Environmental friendliness, performance beyond expectations, and cost savings. In addition, large-scale environmental marketing campaigns will also help change consumer behavior towards "Made in Vietnam" electric car products.

Fifth, solutions to take advantage of "Opportunities" to overcome "Challenges", consumers are still facing "Consumers' fear of new types of products" is one of the challenges for the "Made in Vietnam" car manufacturer. This complements the argument above about the urgency of creating brands and changing consumer habits. The research team believes that it will take many years to do this, but if successful, it will help electric car companies increase revenue and have a stable loyal customer base. This has become extremely important now with the survey results. Anh, N. T., et al (2022) also showed that 65.9% of customers admitted: "Electric cars are gradually becoming a trend". That's why electric car companies need to seize the opportunity and time to build a large and loyal customer base.

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