ENHANCING THE ACCEPTANCE OF THE ADOPTION OF EVS IN MALAYSIA

TONG KOK HUI

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

VERIFICATION

‘ I/ We hereby declared that I/ We had read through this thesis and in my/ our opinion that this thesis is adequate in terms of scope and quality which fulfill the requirements for the award of Bachelor of Technology Management (Supply Chain Management and Logistics)’

Signature : …….....

Name of Supervisor : Madam Adilah Binti Mohd Din

Date : …….....

Signature : …….....

Name of Panel : Dr. Hasan Bin Saleh

Date : …….....

ENHANCING THE ACCEPTANCE OF THE ADOPTION OF EVS IN MALAYSIA

TONG KOK HUI

The thesis is submitted in partial fulfillment of the requirements for the awards of Bachelor of Technology Management (Supply Chain Management and Logistics)

Faculty of Technology Management & Technopreneurship
Universiti Teknikal Malaysia Melaka

FEBRUARY 2025

DECLARATION

"I admit that this report is the result of my own, except certain explanations and passages where every of it is cited with sources clearly."

Signature : .....

Name : Tong Kok Hui

Date : 8 / 2 / 2025

DEDICATION

I want to dedicate my appreciation to my family members who supported me spiritually, my supervisor, and the panel who guided me throughout the journey of research.

ACKNOWLEDGEMENT

In the beginning, I want to say sincere thanks to everyone who helped and encouraged me on my path to completing the final year project.

I am delighted with the assistance of my supervisor, Madam Adilah Binti Mohd Din, for her kind consideration, help with writing skills, and important advice. I sincerely appreciate her for being there to provide me with supportive and relevant insights through her time and effort to bring me across each challenge during the development of this project. She kept offering me alternatives to refine my job and confirm its precision. I am grateful for her patience, guidance, advice, support, and the ability she has provided to acquire knowledge. Also, Dr. Hasan Bin Saleh, whose comments were helpful on my senior project when I presented it.

Furthermore, it is my pleasure to convey my profound gratitude to Universiti Teknikal Malaysia Melaka (UTeM) for allowing me to have a good opportunity to do this research. During this experience, I learned lots of new things which will help me in the future.

Lastly, I want to express my appreciation to all parties who spent the moment to fill out the survey. I am grateful for the backing, motivation, and enthusiasm from my parents and friends while working on this project.

ABSTRACT

This research identifies the barriers that impede Malaysians from acquiring electric vehicles (EVs). Electric vehicles have been a hot topic as more people and organizations have become aware of the impact on the environment. Despite the Malaysian federal government's various efforts to promote the use of electric vehicles, the turnover rate remains low, demonstrating a gap in the country's acceptance of these vehicles. Therefore, the study is carried out to study barriers to the acceptability of electric automobiles in Malaysia. The discussed literature identifies four independent variables: infrastructure, financial, technological, and environmental. The target respondents were non-EV owners with driver's licenses. A quantitative methodology and survey with 384 Malaysian respondents were used in the study. The data is then analyzed through multiple linear regression, descriptive, and Pearson correlation analyses. Based on the results, the adoption of electric vehicles in Malaysia is strongly influenced by four determinants: infrastructure, financial, technological, and environmental. The primary factor driving EV adoption in Malaysia is environmental. Finally, some suggestions for future research were obtained such as working with wider region respondents to include the rural areas, inclusion of EV owners in the sample, focus on the samples from each state in Malaysia, and examining more variables.

ABSTRAK

Kajian ini mengenal pasti halangan yang menghalang rakyat Malaysia daripada memiliki kenderaan elektrik (EV). Kenderaan elektrik telah menjadi topik hangat kerana semakin ramai individu dan organisasi menyedari kesan terhadap alam sekitar. Walaupun kerajaan persekutuan Malaysia telah melaksanakan pelbagai usaha untuk mempromosikan penggunaan kenderaan elektrik, kadar pengambilannya masih rendah, menunjukkan jurang dalam penerimaan kenderaan ini di negara ini. Oleh itu, kajian ini dijalankan untuk mengkaji halangan terhadap penerimaan kenderaan elektrik di Malaysia. Literatur yang dibincangkan mengenal pasti empat pembolehubah bebas: infrastruktur, kewangan, teknologi, dan alam sekitar. Responden sasaran adalah individu yang bukan pemilik EV tetapi mempunyai lesen memandu. Kajian ini menggunakan metodologi kuantitatif dan soal selidik yang melibatkan 384 responden di Malaysia. Data dianalisis menggunakan analisis regresi linear berganda, deskriptif, dan korelasi Pearson. Berdasarkan hasil kajian, penerimaan kenderaan elektrik di Malaysia sangat dipengaruhi oleh empat penentu: infrastruktur, kewangan, teknologi, dan alam sekitar. Faktor utama yang mendorong penerimaan EV di Malaysia ialah alam sekitar. Akhir sekali, beberapa cadangan untuk kajian masa depan diperoleh, seperti melibatkan responden dari kawasan yang lebih luas termasuk kawasan luar bandar, memasukkan pemilik EV dalam sampel, memberi tumpuan kepada sampel dari setiap negeri di Malaysia, dan mengkaji lebih banyak pembolehubah.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND SYMBOLS

IV 1	=	Infrastructure
IV 2	=	Financial
IV 3	=	Technological
IV 4	=	Environmental
H_0	=	Null Hypothesis
H_1	=	Alternative Hypothesis
α	=	Alpha
B	=	Beta

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background of Study

The transport industry significantly contributes to the major global environmental issues of climate change and global warming (Murugan &Marisamynathan, 2022). Globally there is an atmosphere of concern about the environment (Virmani et al., 2023). Most countries are finding effective ways to cut carbon emissions (Asadi et al., 2022). GHG emission is generally the most active factor in global warming, and it usually involves the burning of fossil fuels. For instance, globally, the biggest factor contributing to climate change is considered to be transportation, which contributes about 14% of all carbon dioxide emissions worldwide (Tsai et al., 2024). With the International Energy Agency (IEA) estimating GHG emissions to increase by 1.1% by 2022, the world is on track for a high of 37.4 billion metric tons (Gt) in 2023. Internal combustion vehicles contribute approximately 74% of the emissions, which leads to higher air pollution and energy resource consumption (Pamidimukkala et al., 2023). To decrease emissions, governments worldwide have proposed certain target emissions for the transportation sector (Tsai et al., 2024). Therefore, electric vehicles (EVs) are an appealing tactic to achieve not only reduced carbon footprints, but also decrease reliance on petroleum and coal, and address environmental problems (Pamidimukkala et al., 2023).

The Alternative Fuels Data Center defines an electric vehicle as one that is designed to be recharged from an external power source and uses an electric motor powered by a battery for propulsion. Another definition for EVs is modern technology with zero tailpipe emissions (Kwan et al., 2022). Many types of electric vehicles are available. According to Tsai et al. (2024), HEV is a class of electric cars that consists of an electric motor running on batteries with a traditional ICE, and an internal battery recharge system. The second one is a battery electric vehicle BEV, which comprises only the electric drivetrain fueled via batteries, not an internal combustion engine ICE. This is powered by an internal battery pack, which can recharge via an external source. Thirdly, plug-in hybrid system electric cars have an internal combustion engine. In PHEVs, batteries draw their power from the motor when the ICE is providing electricity to charge the battery pack.

Other than that, Malaysia is among the countries that have pledged to becoming zero net emissions by 2050 and intends to capitalize on the potential of EVs to reach the emission objectives (Energy Watch). According to the International Trade Administration, the market for electric vehicles in Malaysia is relatively minor. The government has also started to introduce some policies to promote the growth of the EV sector as the development of electric vehicles (EVs) is on track in Malaysia. In Malaysia, EV units registered exceed 31,000, with a target by the government to have 125,000 EVs on the road by 2030 (Abdullah et al, 2024). According to the Malaysia Automotive Association (MAA), EVs and hybrids made up 4.76% of the total industry volume in 2023, which stood at 799731 units. In 2023, Malaysia saw electric vehicle sales rise to 10,159 units for the year, up from 2,631 units sold in 2022 (Malaysia Automotive Association, 2023). This is aligned with the Malaysian government's target of reaching 20% annual sales for electric vehicles by 2030 to further accelerate electric vehicle adoption in Malaysia.

To coincide with the national commitment towards the SDGs as well as to achieve the national carbon targets, Malaysia has introduced a Low Carbon Mobility Blueprint and Action Plan (LCMB) 2021–2030. The LCMB is primarily focused on reducing greenhouse gases and energy consumption through electric mobility. In addition to that, Malaysia targets to implement 10,000 electric vehicle charging stations by the year 2050, where currently approximately 1,500 EV charging stations

are already in operation (Malay Mail, 2024). Besides that, as reported by the New Straits Times, Malaysia as recently as Budget 2023 announced an extension of the tax exemption deadline to encourage the uptake of local EVs, which includes excise duty, sales tax, and component tax exemptions. These objectives are to assist EV manufacturers, promote ownership, and stimulate the EV industry. Abdullah et al. (2024) also mention that Malaysia offers a tax exemption for locally manufactured and imported EVs and expands the charging facilities by 2050.

Table 1.1: Driver's license registration population in Malaysia 2021

2021								
Negeri	Umur							Total
	16-30	31-40	41-50	51-60	61-70	71-80	>80	
JOHOR	45,017	30,625	17,577	13,213	7,659	9,206	537	107,100
KEDAH	269,747	156,469	113,793	104,779	52,089	61,283	3,186	705,900
KELANTAN	178,783	147,747	108,211	98,711	42,431	61,652	2,463	567,000
MELAKA	322,729	239,520	197,171	164,204	67,747	82,774	8,309	1,046,400
N_SEMBILAN	183,722	113,140	80,831	68,463	26,642	35,095	1,883	460,900
PAHANG	567,216	386,475	256,411	216,620	121,920	167,056	2,559	1,566,700
P_PINANG	143,539	103,366	60,458	55,458	34,218	42,799	2,300	373,600
PERAK	504,364	337,795	259,460	219,167	98,676	119,962	6,078	1,424,000
PERLIS	162,821	96,220	74,103	63,303	19,539	24,013	803	397,900
SELANGOR	416,558	332,984	218,063	164,551	59,865	31,772	4,249	1,207,100
TERENGGANU	269,641	174,073	164,025	123,189	55,440	57,922	3,567	806,300
SABAH	170,762	122,807	105,712	93,134	38,078	46,244	2,061	541,800
SARAWAK	226,856	170,779	135,353	122,417	66,917	92,459	7,985	742,200
WP. KL	144,215	104,497	75,449	63,640	22,704	18,727	4,279	438,200
Total	4,675,400	3,522,800	2,991,100	2,833,600	1,259,800	1,199,200	60,000	16,771,000

(Source: data.gov.my)

Table 1.1 displays the number of people with a registered driver's license in Malaysia. The total number of people with registered driver's licenses is 16,771,000 in Malaysia. Among the 14 states, the highest number of populations that registered for

driver licenses is Pahang which has 1,566,700 people, and the lowest population is Johor, with 107,100.

Table 1.2: Car Registration Transaction from 2020 to 2024

Category	Year				
	2020	2021	2022	2023	2024
Conventional Cars	550,355	527,067	726,252	796,828	731,535
Hybrid Cars	1,928	2,731	15,377	22,215	21,120
Electric Cars	71	257	3,129	13,301	19,208
Total	552,354	530,055	744,758	832,347	771,863

(Source: data.gov.my)

Table 1.2 shows the number of cars registered from 2020 to 2024. The data indicates the number of hybrid and electric cars has been increasing over the years. The electric vehicle sales increased from 71 units in 2020 to 19,208 units in 2024. In the meantime, traditional car registrations are down slightly in 2024 against 2023. According to the data, more and more Malaysians are going for electric cars.

While there are several government policies targeted at improving the use of electric cars, their number in Malaysia is still relatively low in comparison to conventional vehicles. The slow uptake can be traced to little previous research on EV uptake in ASEAN countries. Schröder and Iwasaki (2021) reported that fragmented efforts to promote EV adoption in the region are mainly due to a lack of coordinated policies among ASEAN nations. This decentralization of development makes it increasingly difficult to promote mass adoption of EVs without a coherent regional strategy. Hence, this research intends to close the knowledge gap through determining the significant factors impacting EV adoption in Malaysia. This study will provide policymakers with a big-picture view of local challenges faced in terms of EV adoption and help them formulate better-targeted strategies for boosting EV adoption in the country.

1.2 Problem Statement

Muzir et al. (2022) state that the Malaysian government encourages the ownership of electric automobiles (EVs) by providing a range of incentives, including tax breaks, financial support for EV spending, and the building of charging facilities. In order to promote broader market penetration, the Ministry of Investment, Trade, and Industry (MITI) launched the Battery Electric Vehicle Global Leaders Initiative (BEV GLI), which permits foreign businesses to sell EVs in Malaysia without being constrained by Approved Permit (AP) regulations.

The manufacturers of electric vehicles can claim a tax exemption for import, excise, and sales tax with effect from January 1, 2022, while buyers are also availing similar tax exemptions on the purchase of electric vehicles in order to help bring the cost to consumers of zero-emission vehicles down. The Low Carbon Mobility Blueprint 2021–2030 finalized by the Malaysian Green Technology and Climate Change Corporation provides a supporting policy framework for the electrification of passenger transport in the country. Besides, the plan to install 10,000 units of the EV charging points for electric vehicles by 2025 is also mentioned in the blueprint to facilitate the transition toward electric mobility.

Despite such efforts, the adoption of EVs remains low in Malaysia. Sales of EVs and hybrid vehicles in 2023 reached 38,055 units out of 799,731 vehicle sales, accounting for only 4.76% of the market. While EV sales are on the rise, from 2,631 units in 2022 to 10,159 units, the market share remains low compared to the overall automotive sector, hence indicating a prevailing gap within Malaysia's electric vehicle adoption. Besides that, such slow growth does indicate the challenges toward meeting the ambitious targets set by the Malaysian government.

Poor EV acceptance in Malaysia will imply several aspects, including that not embracing the EV dream jeopardizes the Malaysian government's commitments in the international arena through agreements such as the Paris Agreement and the 12th Malaysia Plan of 2021-2025 that require tremendous cuts in GHG emissions. Probably, these policies are difficult to achieve due to their reluctance to define the impediment to the adoption. Moreover, the slow adoption of EVs inhibits the growth potential of

the EV sector in Malaysia by affecting economic development, job creation, and the movement toward a greener future for the nation. Therefore, research to identify and subsequently address the challenges preventing electric vehicles from becoming widely used.

Prior research on the acceptance of electric cars (EVs) has identified key barriers to EV uptake such as high upfront purchase prices, a limited selection of models, infrastructure constraints, low consumer awareness, and inadequate government policies and incentives (Tsai et al., 2024; Murugan & Marisamynathan, 2022). In addition, recent studies in Malaysia have highlighted environmental concern, trust in EVs, personal norms, price value, and subjective norms as key drivers (Asadi et al., 2022). Conversely, Pamidimukkala et al. (2023) showed that among the four barriers, technological, financial, and infrastructure barriers greatly influence the adoption of EVs in the US, while the environmental barriers are negligible. This difference indicates that there is a need to conduct a context-specific study on the barriers to EV adoption in Malaysia.

Moreover, Schröder & Iwasaki (2021) also state that little research has been done on EVs in the countries of the ASEAN region, which limits the basis for the design initiatives and programs to boost electric EV adoption in these countries. This emphasizes, as shown by He et al. (2022), explore the barriers and motivations affecting the decision-making process for this cohort.

1.3 Research Questions

The study intended to answer the following research questions:

I. What are the key barriers to promoting the use of electric vehicles (EVs) in Malaysia?
II. What barriers hinder the adoption of electric vehicles (EVs) in Malaysia?
III. What is the relationship between each barrier and the adoption of EVs in Malaysia?

1.4 Research Objectives

This study proposed to study the following objectives:

I. To analyze the most significant barriers to the adoption of EVs in Malaysia.
II. To identify the barriers influencing the adoption of electric vehicles (EVs) in Malaysia.
III. To determine the relationship between each barrier towards EV adoption in Malaysia.

1.5 Scope, Limitation, and Key Assumptions

This study particularly focuses on barriers hindering the use of electric cars in Malaysia. The research gathered information from participants with driving licenses who did not own EVs. This study pointed to three limitations:

1. Geographical scope: The results of the study are focused on the urban areas, and the results cannot be applied to the rural areas with undeveloped EV infrastructure.
2. Sampling bias: The respondents may have been from certain demographic groups, like urban residents or higher-income respondents, which could affect the results.
3. Limited data collection and analysis time: The time available for data collection and analysis at the surveys was minimal, which limited the amount of information that could be obtained.

1.6 Importance of Research

This study identified and analyzed the barriers deterring EVs from achieving widespread adoption in Malaysia. The results of the current study provided suggestions

to policymakers and car manufacturers on how to improve their respective strategies and framed appropriate interventions for specific issues to increase the adoption of EVs. Policymakers and the automotive industry applied these insights in refining their approaches.

The findings of this study made it possible to make more informed choices on infrastructure development, incentives, and regulations targeted at encouraging the use of EVs. By determining the most impactful barriers, policymakers could better focus their investments to increase EV market share and achieve sustainable electric mobility faster.

In conclusion, the specificity with which barriers to EV adoption were identified by the study served to assist policymakers and automotive manufacturers in taking informed steps toward improving their strategies and implementing specific measures that would facilitate the adoption of EVs.

1.7 Summary

This chapter serves as an overview of the six sub-chapters that are comprised within the overall research. Starting with the study's topic gives background data about electric vehicles and their wide adoption in Malaysia. The problem statement follows next. Third, the objective of the research is to find the barriers influencing the acceptance of electric cars or EVs. After that, the limitations of the study, main assumptions, and scope are discussed. Finally, the value of the study is highlighted. The study is important to researchers who would like to fill the knowledge gap regarding challenges to Malaysians' uptake of electric cars and provide useful information to policymakers to help them devise effective policies.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The topic of this chapter focuses on the definition of electric vehicles (EVs), and the various factors affecting the adoption of EVs among citizens. More specifically, we are interrogating the barriers that impede the acceptance of EVs in Malaysia, including infrastructure, financial, technological, and environmental. There are several peer-reviewed articles and studies on EV adoption available in the literature associated with this research question. Identifying the correlation between these hurdles and the adoption of electric vehicles in Malaysia.

2.2 Electric Vehicle

EVs are the cutting-edge at the forefront of transportation. The vehicles have electric motors that operate them and run on stored electricity as opposed to internal combustion engines (Pamidimukkalaa et al., 2023) This can be avoided by adopting the electric vehicle (EV) which not only minimizes air and gas emissions but also helps in conserving the environment (Murugan & Marisamynathan, 2022). Their lower energy consumption, maintenance, and emissions make them cheaper to run than internal combustion engine vehicles (Alanazi, 2023; Murugan & Marisamynathan,

2022). Furthermore, the dependency of EVs on electricity for propulsion serves as a clean substitute for cars that run on fossil fuels, leading to a cleaner environment (Virmani et al., 2021). Thus, EVs are key to overcoming climate change, limiting carbon dioxide emissions, and improving energy efficiency (Kongklaew et al., 2021).

Muzir et al. (2022) classify EVs into four classes as follows: Battery Electric Vehicles (BEVs) produce no exhaust emissions and run exclusively using electric batteries. PHEVs are very much an energy source of two halves, packing an internal combustor along with an electric motor and battery. HEVs employ a combustion engine as well as an electric motor to improve fuel consumption and reduce emissions. Hydrogen is employed to produce energy and releases only clean water vapor; thus, it is utilized in Fuel Cell Electric Vehicles (FCEVs).

Diverse sectors are putting EVs to new uses that are taking root across regions. They are also used for making instant deliveries and route optimization due to energy consumption in urban areas (Galindo-Muro et al., 2023). Furthermore, concepts such as Vehicle-to-grid(V2G), where energy can flow both ways and maximize profits by connecting EVs to renewable energy have been included in the energy networks leading to EVs being integrated into this mechanism and bringing along a different perspective to transition to a low carbon economy (Coban, 2022). Learning how well EVs work at hot temperatures is essential to improve performance and accelerate adoption, particularly in areas that are still highly dependent on the burning of fossil fuels, including Kuwait (Bahaj, 2023).

2.3 Determinants that Influence the Adoption of Electric Vehicles (EVs)

There are four identified determinants in this study: infrastructure, financial, technological, and environmental.

2.3.1 Infrastructure

Charging stations are an important feature of infrastructure. One of the main obstacles to EV consumers' acceptance has been found to be driving range (Murugan & Marisamynathan, 2022). Infrastructure availability and serviceability could hinder EV adoption, which encompasses maintenance services, fueling infrastructure, and support service facilities. Studies have remarked that the lack of public charging infrastructure and the unavailability of maintenance and repair services may dissuade people from buying EVs (Kongklaew et al., 2021; Pamidimukkala et al., 2023; Tsai et al., 2024). Pamidimukkala et al. (2023) point out that the lack of infrastructure can work against EV adoption intentions, thus reinforcing the importance of overcoming the challenges identified to support the move towards electrification of vehicle groups.

In another study, Tsai (2024) observes that both EV and non-EV owners are concerned about public infrastructure. The study employs the technique of Delphi to uncover critical barriers and determine their relationship using the DEMATEL method in Thailand. Additionally, according to Kongklaew (2021), the distance between cities and high land prices in metropolitan and major cities pose significant obstacles to establishing specific charging stations, making public infrastructure preferable to home and highway infrastructure. But workplace infrastructure appears to be less of a barrier due to the individual use of EVs on trips or holidays. Public infrastructure is one of the key challenges limiting EV adoption in Thailand.

Additionally, Asadi (2022) investigated the determinants that affect consumer adoption of EVs in Malaysia. The results show that factors including price, charging threat, and confidence in EVs affected the adoption of EVs in Malaysia significantly with the charging infrastructure. More specifically, they affect customers' perceived value and perceived risk of charging an electric vehicle through the accessibility of charging infrastructure. Easy access to charging stations can prove to the customers that there is ample availability of charging stations so they need not find it difficult to travel long distances without fear, and this can play an important role in the EV adoption in Malaysia.

2.3.2 Financial

Financial which involves barriers in terms of expenses or other cost and financial aspects in the transition to electric vehicles (EVs), such as high initial costs, high replacement costs, resale values, and concerns about the total cost of ownership of EVs in contrast to traditional fuel vehicles. The importance of finances to EV adoption has been proven in previous literature due to the price sensitivity among consumers and the high initial prices of EVs (Pamidimukkala et al., 2023).

The high ownership costs, including the cost of replacing batteries, pose substantial impediments to electric car adoption, as evidenced by recent studies. Number one hurdle to the adoption of EVs in the Indian EV market is the cost factor, which requires policies that should reduce the initial cost of EVs and make them more competitive vis-a-vis conventional vehicles (Murugan & Marisamynathan, 2022). Because EVs do not benefit from economies of scale, EVs tend to cost more, which causes consumers to pay a higher price tag on electric vehicles than on internal combustion engine vehicles (Kongklaew et al., 2021).

A survey conducted in Thailand reported that EV owners have more concerns about maintenance expenses, the cost of replacing batteries, and the availability of repair and maintenance facilities compared to the general population. In another publication by Pamidimukkala et al. (2023), which shows that key barrier to EV adoption intention is financial, as people sensitive to price care about costs first and foremost. This shows that reducing overall acquisition costs will stimulate the adoption of fuel-efficient vehicles.

2.3.3 Technological

In recent study conducted by Pamidimukkala et al. (2023) and Xue et al. (2024), the following technological barriers were recognized as challenges that EV technology faces today. The limitations entail a narrow driving range, lengthy charging duration, limited life of batteries, thoughts about the overall trust and safety of EVs,

etc. High energy densities via miniaturized battery packs and fast charging rates are usually unfavorable to existing Lithium-Ion Batteries (LIBs), resulting in longer charging times (Roy et al., 2022). Technology lags sometimes deter prospective buyers, who may find electric vehicles inconvenient and lacking in capabilities.

Aungkulanon et al. (2023) characterize these limitations as technology-related challenges that pose barriers to widespread adoption. These technical barriers result in anxiety and inconvenience for prospective buyers impacting their decision to adopt EVs (Virmani et al., 2023). In addition to this, Alotaibi et al. (2022) lists significant technical challenges such as the safety and efficacy of batteries at high temperatures that impact the performance of EVs in severe cases.

According to Aungkulanon et al. (2023), Thailand faces a number of technological challenges that limit the uptake of electric vehicles (EVs). This study proves by ranking the barriers that have been identified by the Fuzzy Analytical Hierarchy Process (FAHP), that the most important sub-barrier is EV charging time EV and that the technology barriers are the second most important barrier in EV acceptance. It highlights the role of technology in working towards furthering EV adoption in Thailand and a multi-level charging infrastructure development for the effective prediction of EV promotion.

2.3.4 Environmental

Environmental issues are a key contributor to the mass acceptance of electric vehicles (EVs). Kuo et al. (2022) and Aungkulanon et al. (2023) highlight that people are particularly concerned with the sustainability aspect of EV adoption. Among these worries is fear over how much will be lost to EV's batteries, particularly their disposal and recycling. The need for this issue has been emphasized in studies that looked at the challenges of EV uptake, particularly in cases like Saudi Arabia. Moreover, consumer perceptions on the relative environmental benefits associated with EVs versus internal combustion engine vehicles (ICEVs) are a major factor impacting EV adoption rates. It is clear that consumer adoption of EVs will indeed be responsive to

the environmental performance in a general sense, even though some of the research suggests that environmental factors are not as decisive as one would expect (Anastasiadou & Gavanas, (2022).

Based on research by Pamidimukkala et al. (2023), the study concludes that environmental barriers only have a non-significant role in the intention of EVs in the US. Austmann and Vigne (2021) similarly find that environmental awareness has an influence on consumers of electric vehicles (EVs), since EV production may emit. However, several studies argue that consumers continue to view EVs as better for the ecosystem compared with traditional gasoline-powered vehicles due to advances in battery reuse technology and growth in renewable resources. In this study, the findings show no relationship between environmental barrier, attitude, and intention to adopt EV; accordingly, further research is required.

In addition, according to the study performed by Asadi et al. (2021), environmental awareness is the least influencing factor for EVs adoption in Malaysia. The results of this study are different from that of Pamidimukkala et al. (2023) reported that people in different parts of the world hold different views. Mustafa et al. (2024) discover a vital role of environmental awareness from the people in China in the electric vehicle's uptake. This shows people are increasing awareness of today's environmental changes, people would think about the eco-friendliness of electric vehicles (EVs) before buying new cars.

2.4 Electric Vehicle (EVs) Adoption

The transition from internal combustion engines to electric vehicles (EVs) is known as EV adoption. Many factors including technological advancements, economic rewards, and ecological advantages can support this change. Rechargeable batteries power electric vehicles (EV) and electric motors (Jung et al., 2023). Exponential growth trends indicate that the electric models will account for a large proportion of the passenger cars on European roads by 2031, according to recent

studies forecasts. Dinesh and Mitra (2023) explain that extraversion and conscientiousness will influence the attitude of Indians to accept electric vehicles.

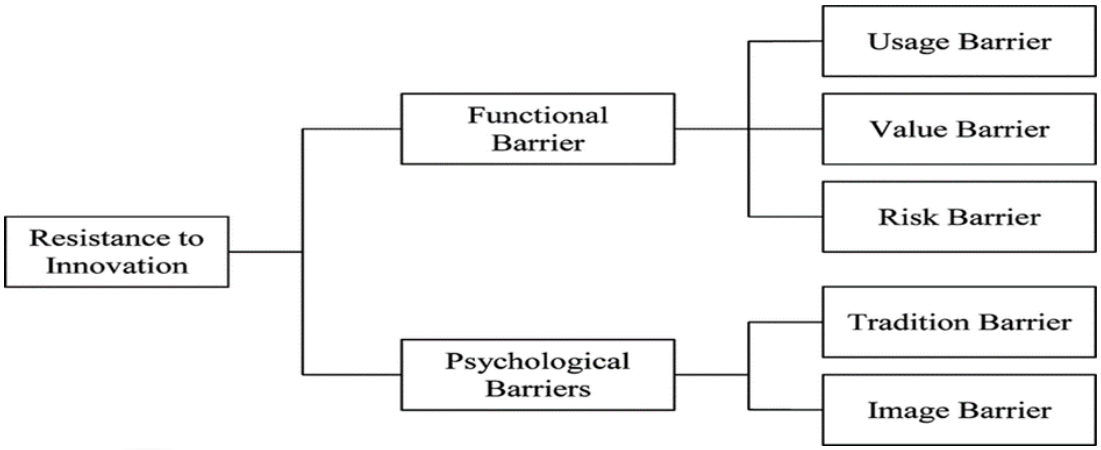
The lack of charging infrastructure and driving range anxiety are noteworthy barriers to widespread electric vehicle (EV) adoption (Tiu et al., 2023). Implementing strategic measures, for instance, optimizing the placement of various charging stations and improving the distance each EV can cover on a single charge cycle, can help overcome such issues and boost the public confidence in EVs considerably.

According to Wong et al. (2023), innovative charging systems can effectively regulate the rising consumption of electricity for EVs. The motivation schemes are based on financial incentives and with the provision of free EV charging a community group point out the integration of electric vehicles into modern electricity networks. According to Haryati et al. (2023), social networks, technology literacy, and accessibility in technology become significant factors to influence the number of visitors to EV charging stations in Indonesia.

Nigeria should immediately introduce renewable energy sources to its energy portfolios to move the EV value chain further (Ajao & Sadeeq, 2023). In Thailand, the absence of government support and charging infrastructure creates significant obstacles, highlighting the need for targeted policy interventions (Aungkulanon et al., 2023).

Media influence and social norms can significantly affect consumers' willingness to adopt new energy vehicles. Perceived utility and usability have a great effect on these intentions (Pang et al., 2023). Furthermore, Bryla et al. (2022) highlight how important public policies, tax breaks, and awareness projects are for increasing EV adoption rates. These programs offer financial inducements and tackle customer perceptions of risk-versus-benefits, paving the way for similar adoption of electric vehicles.

2.5 Innovation Resistance Theory (IRT)



(Source: Ram and Sheth, 1989)

Figure 2.1: Innovation Resistance Theory

The Innovation Resistance Theory (IRT) was proposed by Ram and Sheth (1989) to provide a conceptual roadmap to identify and reduce inhibitors for the diffusion of new products or technologies. The underlying theme of the theory looks at the hurdles and elements that prevent the acceptance and adoption of novel technologies by consumers. In essence, the IRT is the theory that explains consumer resistance-oriented behaviour (Kaur et al., 2020).

Innovation Resistance Theory (IRT) has been applied in various fields to examine consumer resistance to innovation. In addition, there is still a lack of focus on resistance to innovation in the existence of the theoretical framework, diffusion of innovation, and the technology acceptance model. Furthermore, IRT aims to elaborate the consumer's response to use, risk, value, tradition, and image relative to the innovation (Kaur et al., 2020). This goes deeper for the understanding of customer behavior and the resistance to technology adaption.

The previous study by Xue et al. (2024), it was applied to explore how three functional and psychological barriers influenced customer purchase intention of electric vehicles (EVs). The usage, value, risk, and tradition have a negative effect on the electric vehicle purchase intention. Additionally, Chu (2023) investigates the IRT of advanced driver-assistance systems to provide insights to comprehend consumer

resistance of the technology. This indicates the IRT is the right framework for understanding the adoption of electric vehicles (EVs) in Malaysia.

2.6 Theoretical Framework

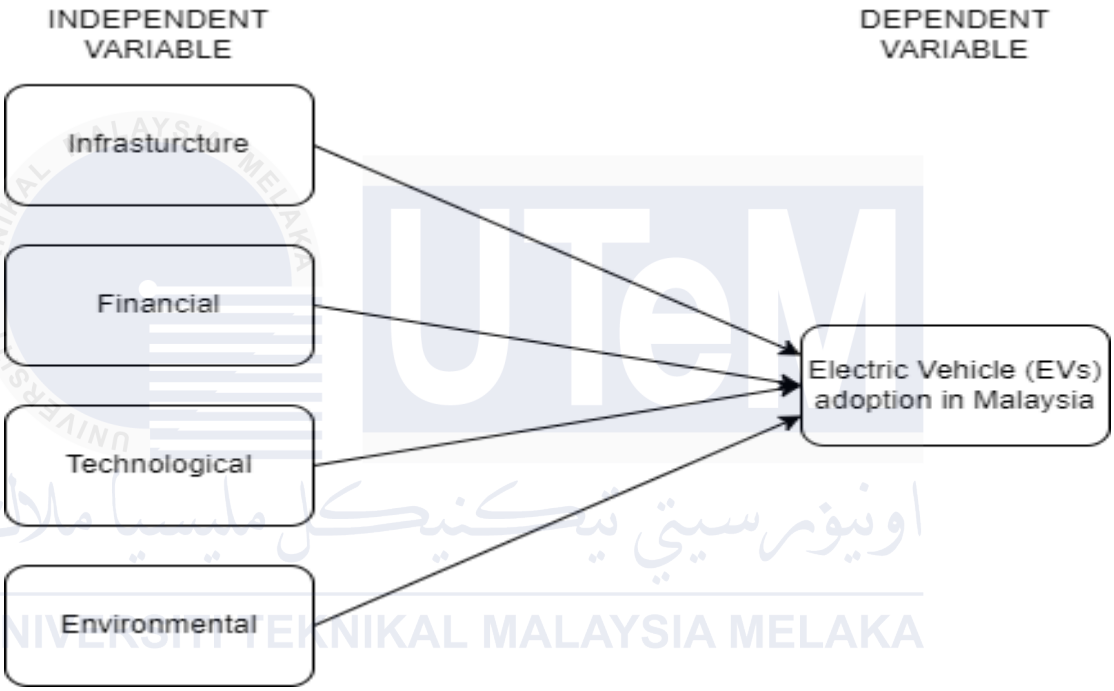


Figure 2.2: Theoretical Framework of Electric Vehicle (EV) Adoption

Figure 2.2 illustrates a proposed framework regarding the theory of EV adoption. The theoretical framework of this study is adapted based on Innovation Resistance Theory (IRT). Data collection and analysis method with the theoretical framework This theoretical framework is then applied to understand and identify the factors influencing the EVs adoption in Malaysia. Previous studies of Xue et al. (2024) adopt the innovation resistance theory (IRT) to study functional and psychological barriers influencing customers' intentions to purchase electric vehicles (EVs). Therefore, in this study, the researcher uses the Innovation Resistance Theory (IRT) to explore the challenges to EV adoption.

As shown in Figure 2.2, there is a hypothetical model with four independent variables where all hypothesized effects are on the dependent variable. These hypotheses explore the association between each independent variable and electric vehicle (EV) adoption to determine whether this relationship is positive or negative. The study identified four independent variables infrastructure, financial, technological, and environmental. Infrastructure also relates to the abundance and accessibility of charging stations (Kongklaew et al., 2021). Economic comprises of the price of EVs where the upfront cost of buying electric vehicles comparatively greater over traditional vehicles, lesser resale price, as well as price of battery (Pamidimukkala et al., 2023). Then, technological refers to the real current technological shortcomings of EVs like battery lifespan, driving range, and charging time (Virmani et al., 2023). Environmental factors include battery production and battery disposal (Pamidimukkala et al., 2023). These independent variables could affect electric vehicle adoption in Malaysia.

2.7 Hypothesis of Study

The following is the hypothesis proposed for this study:

Infrastructure

H_0: There is no significant relationship between infrastructure and the adoption of electric vehicles (EVs).

H_1: There is a significant relationship between infrastructure and the adoption of electric vehicles (EVs).

Financial

H_0: There is no significant relationship between financial and adopting electric vehicles (EVs).

H_1: There is a significant relationship between financial and electric vehicle (EV) adoption.

Technological

H_0: There is no significant relationship between technological and adopting electric vehicles (EVs).

H_1: There is a significant relationship between technological and electric vehicle (EV) adoption.

Environmental

H_0: There is no significant relationship between the environmental and adopting electric vehicles (EVs).

H_1: There is a significant relationship between the environmental and adopting electric vehicles (EVs).

2.8 Summary

In this chapter, a literature review is performed on this subject where the independent variables (infrastructure, financial, technological, and environmental) and the dependent variable (adoption of electric vehicles) were compared based on prior similar studies. As a result, it aids the readers to learn the relation between independent and dependent variables.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

According to Marhasova et al. (2022), research technique is a systematic approach to addressing a research problem which involves data collection, analysis and conclusions based on the research. This includes choosing the right research method, statistical analysis, and the significance of certain methods in solving certain research problems. The data gathering and analysis procedures involved in the research project are presented throughout this chapter. The research design shows the framework and procedure of data collection in this study. The association between both the independent and dependent study variables is then being examined using the quantitative technique. The findings of the research are presented by sample methodologies and design. Then, the method of data collection is decided. Towards the end, the analysis technique for data was developed to explore the data collected from the participants. Relevant directions are outlined in this chapter to assure the correct implementation of the study technique, as well as to guarantee the outcomes are optimal.

3.2 Research Design

As defined by Glomb (2023), research design is the overall strategic framework for acquiring, analyzing, and explaining data to address research

questions and verify hypotheses. Research design must be developed to make sure validity, reliability, and generalizability of research findings. It includes elements such as the question being studied, the assumption, collection of data, organization ways, and other elements that guide the research. Put another way, a research design is a guideline for the researcher to conduct the research following steps and procedures to make sure that the result is valid and reliable. According to Indu and Vidhukumar (2020), research design is the framework used in a research study to make decisions about the relationship between independent and dependent variables.

Exploratory, descriptive, and explanatory research are the common types of social sciences research. Mirkhanov et al. (2023) characterize exploratory research as the examination of new themes, processes or places that are poorly known or understood. It is suitable for use in a previously unstudied line of inquiry. This study mainly serves the goal of gaining insight, forming a hypothesis, or perceiving trends that can be further investigated. It describes the neglected phenomena using data mining rather than theory. Exploratory research uses qualitative methods like interviews, observations, or focus groups to help the researcher better understand the issue (Tsang, 2023).

On the other hand, a descriptive study occurs when it aims to describe and characterize an observed phenomenon or situation (Lounis, 2020). This study mainly provides a comprehensive overview of the subject under investigation. Descriptive studies are mostly implemented to collect and analyze quantitative data from surveys or questionnaires. Meanwhile, an explanatory study seeks to clarify how the variables relate to one another. In other words, this study explains why certain phenomena will happen and establishes a connection between cause and effect.

In this study, the researcher utilized a descriptive approach to gain a deeper understanding of the factors affecting electric vehicle adoption in Malaysia. Descriptive study addresses what, where, when, and how questions and offers a highly detailed view of the phenomenon. The researcher opted for the descriptive study as the research design to achieve its objectives, given how the research problem was previously identified in previous research.

3.3 Methodology Choice

Three common strategies for conducting research include mixed methods, qualitative methods, and quantitative methods (Williams 2007). The researcher should choose the appropriate approach based on the data type to respond to the research problem. The quantitative method responds to the research problem with numerical data, the qualitative approach responds with textural data, and the mixed-method approach responds with both numerical and textual data. In this study, the researcher implements the quantitative approach to conducting the research compared with the qualitative and mixed-method approaches.

Quantitative research approaches use a numerical or statistical approach to research design. Relational question-related variables within the research can be addressed by quantitative research. Besides that, Creswell (2003) states that the quantitative research method uses the survey, experimental, and collected data based on predetermined tools to produce statistical data. Therefore, quantitative research methods are used in this study to identify and understand the barriers that influence the adoption of electric vehicles. Moreover, quantitative research methods can provide a large number of reliable data that can be used to establish generalizable conclusions. Finally, the quantitative research method ensures that the studies can be replicated, enhancing the reliability and validity of the results.

3.4 Data Sources

Data sources are important in the study for collecting data to solve the research problem. Mazhar et al. (2021) state that data is a piece of information that can be collected during the study, experiment, observation, and survey. There are two types of data sources: primary data and secondary data. Primary data is the data that is collected for the first time, original, and fresh. Usually, primary data is collected from the results of the experiment. However, in the descriptive type of research, the primary data in this situation are gathered from observation or surveys via direct communication with the respondent (Mazhar et al., 2021). There are numerous

techniques for collecting primary data, including observation, interviews, questionnaires, timetables, warranty cards, mechanical devices, and in-depth interviews. The researcher uses the survey to acquire information and data from the respondents to identify and analyze the correlation between the independent variables and dependent variables. Questionnaires are often the preferred method for collecting data in large survey studies. A questionnaire is a set of predetermined questions given to the respondent to collect data. This instrument is useful in getting information from a large number of respondents. The respondents are required to complete the questionnaire, which contains the measure of the independent variable under study on a Likert scale.

Furthermore, secondary data is second-party data in which another person has collected the data. According to Mazhar et al. (2021), the findings show that data collected by someone previously and already undergone the statistical process is called secondary data. Secondary data sources include publications from foreign governments and international societies, academic journals, books, magazines, newspapers, and research specialists' reports. In this study, the researcher uses sources, including books, academic journals, newspapers, articles, and government databases, as secondary data for conducting the research. The researcher makes the secondary data collection through Scopus, Google Scholar, and the library database to support the research purpose.

3.5 Location of Research

The research is being carried out in Malaysia. Malaysia is a Southeast Asian country located on the island of Borneo. Malaysia has a total size of 330,803 square kilometers, with the Peninsular Malaysia region covering around 131,598 square kilometers and East Malaysia covering 198,605 square kilometers. Malaysia is divided into thirteen states and three federal areas. According to the Department of Statistics Malaysia (2023), Malaysia's overall population in 2023 would be 33.3 million, with around 70% of the population aged 15 to 64 years.

Malaysia is selected as the research location because Malaysia has conducted less research on the barrier to adopting electric vehicles (EVs) than neighbouring countries like Thailand and Indonesia (Abdullah, 2024). Besides that, Malaysia ratified the Paris Agreement on November 16, 2016, showing its commitment to the global effort to combat change in climate. The United Nations Framework Convention on Climate Change (UNFCCC) introduced a historic international agreement known as the Paris Agreement. Following the 12th Malaysia Plan (2021-2025), Malaysia's prime minister announces to achieve net-zero GHG emissions as early as 2050. Therefore, Malaysia is the appropriate location for conducting research related to barriers hindering the popularity of electric vehicles. The researcher believes that the respondents in Malaysia can provide valuable information in order to gain more insight into the research topic.

3.6 Sampling Design

Sampling is a statistical procedure for obtaining a sample from a given population to be observed and examined (Mohapatra, 2020). Choosing a representative sample is a broader process that seeks to ensure that the sample can generalize to a larger population. To lower the bias of the chosen sample and improve the quality and trustworthiness of the data, sampling techniques are employed. The Sampling Process of this study encompasses five elements: target population, sampling frame, sampling element, sampling technique and sampling size.

3.6.1 Target Population

The population being studied involves to the entire set of individuals or elements that the researcher wants to evaluate, and from whom the conclusions are to be drawn. As Gupta (2023) states, the target respondent is selected from a lot of potential respondents through pre-defined parameters. The research questions must be used to determine your group. Depending on the prerequisites, appropriate definition

is significant to recognize the target population before conducting the study for valid results and its applicability. Thus, the target population for the study is drivers who do not own an EV. Broadbent et al. (2021) suggest that the EV-positive group is a potential customer base for the development of the EV market. Tan et al. (2019) discovered that those with driver's licenses tend to be more likely to purchase cars due to their driving experience and confidence.

Moreover, due to the relatively low penetration of EV adoption in Malaysia compared to other countries, understanding the factors encouraging adoption as well as recognising obstacles to adoption is important. Non-EV owners' perception of the world and their barriers to adoption are crucial for policymakers to understand, ensuring informed solutions to encourage their uptake of electric vehicles in Malaysia. Other than that, those who are financially independent and do not own EVs will still be the best target market for electric vehicles as they can always purchase their car of choice.

3.6.2 Sampling Frame

A sampling frame is the list of the elements or members of the population from which the sample is drawn. It is essential that the representative for the research study is selected appropriately to prevent any sampling bias. The sample frame constitutes an integral part of the research design process as it directly influences the validity and reliability of the study outcomes. This study was conducted on surveys and questionnaires filled by individuals in Malaysia who do not own electric vehicles (EVs) yet hold a valid driver license. The aim is to find out how this particular sector racial demographic you can work through the barriers for EV adoption.

3.6.3 Sampling Element

The target respondents of the study are non-EV owners with valid drivers' licenses. The outcomes of demographic data include gender, race, age, education level, income level and employment are part of the study sample.

3.6.4 Sampling Technique

Sampling is a statistical method to choose a portion of the people to accurately come out a conclusion about the whole group. To minimize bias and to enhance external validity, the selected sample should be representative of the population of interest. They include two sample methods adapted into research which are probability sampling and non-probability sampling (Brough, 2019).

Probability sampling means that each member or object in the desired population has a comparable probability of having been chosen for the sample. In general, probability sampling is more difficult, more time-consuming, and more expensive than nonprobability sampling. If researchers want results that reflect predictions for the entire population, it is a more valid strategy. The four types of probability samples most commonly used are simple random samples, systematic samples, stratified samples, and cluster samples.

A non-probability sample indicates all of the members or items in the population are chosen based on non-arbitrary standards as a result not all of the members or items have a likelihood of being picked as a representative. This is a non-probability sampling technique which is much simpler and cheaper than probability sampling techniques. The result is more prone to sampling bias. To clarify, this is a weaker argument regarding making a conclusion about the population from this sampling method, as compared to probability sampling. Simple random sampling will be the method of sampling used for this study. As stated by Brough (2019), with simple random sampling, each member or item of the population has the same chance of being selected as the sample.

3.6.5 Sampling Size

According to Serdar et al. (2021), the size of the sample is the number of components and participants that are incorporated when conducting the research to guarantee reliability and the possibility that the results will correspond to the general public. The size of the sample will be drawn from the population. Serdar et al. (2021) also state that a larger sample size will increase the study's reliability, while a small size of the sample results in results that are not trustworthy. In this research, the target respondents are non-EV owners with driving licenses.

In Malaysia, there are 15.8 million people with a driving license (Mamat, 2021). According to Krejcie and Morgan (1970), for a total population of 15.8 million, approximately 384 respondents are required to guarantee the results' dependability and the ability to be general. Therefore, this study focuses on individuals with a driving license, and 384 questionnaires will be distributed to the target respondents. Below is a table providing guidelines for selecting sample sizes required for populations of different sizes.

Table 3.1: Sample size for different sizes of population

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

3.7 Research Strategic

A research strategy is a systematic plan that is applied in the process of conducting the research. It is a critical item in research methodology outlining the approach to address the research questions and objectives. According to Fu (2023), the research strategy is constructing the structured and predefined study design to measure and classify data accuracy. This research uses a survey strategy to collect the data online to meet the research objective. With this study plan, researchers can gather information using various tools, including questionnaires and open-ended inquiries. The researcher employs the questionnaire to collect data regarding the barrier adoption of electric vehicles in Malaysia. Then, the quantitative data will be analyzed using descriptive analysis to demonstrate and describe the results.

3.7.1 Questionnaire Design

The questionnaire is a quantitative method to collect data in the form of an a set of inquiries. Many questions are included in the questionnaire. To ensure the subsequent data analysis, the researcher prepares closed-ended questions for the respondent. The questionnaire is appropriate for collecting data in most cases to reduce the time-consuming and cost-effectiveness. The questionnaire questions are based on the barriers that impact the uptake of electric vehicles (EVs) in Malaysia. Besides that, the questionnaire will be written and designed using English to communicate with the respondents easily. Researchers conduct surveys online using Google Forms, and the target respondents are required to complete the survey using this type of research tool.

The questionnaire is developed in three sections: A, B, and C. Each section has the relevant questions provided to the respondent for an answer. Section A's first section consists of information of demographics such as gender, race, income level, occupation, and educational background. Section A provides clear background information to comprehend the respondent. The second section, Section B, consists of 4 barriers that influence the uptake of electric cars (EVs) in Malaysia. Section C involves the question regarding adopting electric vehicles (EVs). Section B and

Section C have questions regarding the independent variables (infrastructure, financial, technological, and environmental) and the dependent variable (electric vehicle (EV) adoption), and they are scored on a five-point Likert scale in this study. A five-point Likert scale will be used for the respondent to answer the query so that the researcher can collect data.

Five-point Likert Scale				
1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

Table 3.2: Five-point Likert Scale

3.7.2 Pilot Test

A pilot test is an initial testing that is conducted in order to measure the practicability, time, cost, and hazards of the study. The term 'pilot' means to ascertain whether a project, strategy, or plan can be successful. Kothari (2004) states that the questionnaire was piloted to test if there were any errors in it and to ensure that it could effectively collect relevant data. If the questionnaire is experiencing some issues, the questions can be enhanced in order to ensure that the consolidated information collected is accurate. Essentially, the pilot test helps researchers assess and re-evaluate a potential study's idea, process, and questionnaire before it is delivered at scale. It helps researchers determine any prospective problems and make changes that are needed. where necessary to maintain the integrity and reliability of the research.

The researchers pilot tested 30 questionnaires before administering them to the target respondents in the study. The pilot test can uncover potential issues in the questionnaire, such as ambiguous questions, complex terms, and Grammar mistakes. The researcher able upon identifying his mistakes, then improves it and helps to ensure that the questionnaire is acceptable and trustworthy.

3.8 Time Horizon

The researchers were given 16 weeks to complete Final Year Project 1. Researchers were briefed about the final year project during the third week and then made a matrix table. Then, a problem statement table and topic selection were proposed in the fourth week. After selecting the topic, the researcher revised the problem statement table in the fifth, sixth, and seventh weeks. After finishing the problem statement table, the researcher started writing Chapter 1 in week nine and revised it in week ten. The researcher began to compile and organize the information for Chapter 2 during week ten. The researcher completed the revision and had a conversation with the supervisor in week eleven before starting to process the material for Chapter 3. Researchers worked on Chapter 3 during weeks twelve and thirteen. The researcher revised the proposal with their supervisor after finishing chapters one through three. Besides that, the presentation of the proposal started on June 25, 2024. Afterward, the researcher revised the Final Year Project Report in week sixteen.

The researcher was given 15 weeks to complete the Final Year Project 2. In week 1, the supervisor provided a brief overview of FYP 2. From week 2 to week 4, the researcher revised the questionnaire and had it reviewed by the supervisor to ensure its quality. In week 5, a short meeting was held with the supervisor to finalize the questionnaire and start creating a Google Form for data collection. Data collection began in week 5 and continued through weeks 6, 7, and 8, overlapping with the semester break. After that, the researcher met with the supervisor to get advice on drafting Chapters 4 and 5. Chapter 4 was written in week 10, and Chapter 5 in week 11. After finishing Chapters 4 and 5, the researcher rechecked the report and submit it to supervisor for check. In week 12, revisions were made based on the supervisor's suggestions, and Final Year Project 2 presentation stated on week 13. After finishing the presentation, the researcher was going the final revision of the Final Year Project Report. Finally, the final report was submitted on week 15.

3.9 Scientific Canons

The researcher used a methodology of validity and reliability to identify and evaluate the research quality.

3.9.1 Reliability

In quantitative research, reliability is referred to as the accuracy and constancy of the readings used in a research study (Kong, 2017). To ensure the results have consistency and repeatability, these have to be sought at a level which increases the validity of study findings. In addition, it is crucial in determining disease severity, treatment response, and structural integrity. Reliability is influenced by factors such as imaging methodologies, observer variability, and data processing methods (Hakulinen et al., 2021).

According to Babu and Kohli (2023), there are four types of reliability: test-retest, interrater, parallel forms, and internal consistency. Test-retest reliability refers to the extent to which a single test yields consistent results for the same sample at different times. Tests scores were analyzed for intrarater reliability on the same rater. Interrater reliability refers to how much different researchers agree when rating the same item. An external correlation existed between 2 tests that were meant to assess the same item (parallel forms). Internal consistency, the last metric, assesses how closely several test items measure the same thing.

There are several ways you can measure reliability. In this study, reliability of the result will be measured by using Cronbach's alpha method. Cronbach's alpha method is reliability measure of internal consistency used to evaluate the extent to which a group of items are closely related. It tests the stability and reliability of the latent-variable-assessing questionnaire most of the time.

Table 3.3: Cronbach's Alpha

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 \geq \alpha \geq 0.8$	Good
$0.8 \geq \alpha \geq 0.7$	Acceptable
$0.7 \geq \alpha \geq 0.6$	Questionable
$0.6 \geq \alpha \geq 0.5$	Poor
$0.5 \geq \alpha$	Unacceptable

(Source: Lee Cronbach, 1951)

Cronbach's alpha and internal consistency are displayed in Table 3.3. A question set containing consistent responses leads to a higher value of Cronbach's alpha. This consistency reasons that the items measure the same things, and that the measurements are reliable. The opposite would be a low Cronbach's alpha score indicating that the items were unreliable or assessed different things.

3.9.2 Validity

In the quantitative technique, validity refers to the degree to which research assesses what it is intended to assess, ensuring the reliability and trustworthiness of the findings (Singh et al., 2023). For instance, a study that focuses on measurement of uncertainty points out that calibration, consistency and adaptability are all fundamental characteristics of the validation process. Validation refers to the process of evaluating such parameters as accuracy, precision, and dependability in hypothesis testing to ensure that the results obtained are authentic and documented (Surucu & Maslakci, 2020). In this research, the three types of validity including construct validity, internal validity and external validity are used.

Construct validity is concerned with the degree to which a test or other tool accurately measures what it is intended to measure. It is important that the instruments accurately reflect the theoretical concept and be compatible with other established

measures. For this reason, the researcher validates it in the study using a self-administered questionnaire and selecting the respondents to be non-EV owners to ensure the validity of the results.

Doctor et al. (2022) reveal that internal validity is the accuracy with which a study measures the relationship between variables without external influence. Several quantitative empirical research approaches prioritize different aspects of internal validity. These methods include surveys, field trials, and laboratory studies. In this study, all participants answer identical questions within a specified time frame to ensure internal validity.

External validity is the amount to which a study's findings may be generalized or applied to contexts, people, or conditions other than the study itself (Babashahi et al., 2022). In this study, the researcher implements simple random sampling techniques to ensure the sample represents the larger population in Malaysia. Besides that, the researcher includes diverse participants, ensuring that respondents from diverse backgrounds are included in the study to make the findings more generalizable.

Table 3.4: R table of Pearson product-moment

N	r	N	r	N	r	N	r
3	0.997	18	0.468	33	0.344	48	0.285
4	0.950	19	0.456	34	0.339	49	0.282
5	0.878	20	0.444	35	0.334	50	0.279
6	0.811	21	0.433	36	0.329	51	0.276
7	0.755	22	0.423	37	0.325	52	0.273
8	0.707	23	0.413	38	0.320	53	0.270
9	0.666	24	0.404	39	0.316	54	0.268
10	0.632	25	0.396	40	0.312	55	0.265
11	0.602	26	0.388	41	0.308	56	0.263
12	0.576	27	0.381	42	0.304	57	0.261
13	0.553	28	0.374	43	0.301	58	0.258
14	0.532	29	0.367	44	0.297	59	0.256
15	0.514	30	0.361	45	0.294	60	0.254
16	0.497	31	0.355	46	0.291	61	0.252
17	0.482	32	0.349	47	0.288	62	0.250

(Source: Duwi Priyatno, 2009)

Table 3.4 displays the r table of the Pearson product-moment. These are the tools applied to identify and measure the relationships between variables in a questionnaire to assess the construct validity of the questionnaire. A total of 30 participants take part in a pilot test in this study to pre-test the questionnaire. Therefore, the critical value for N=30 is equivalent to 0.361 based on the previous table. As a result, each questionnaire item's value must be more than or equal to 0.361. Thus, the only conclusion that can be drawn is that the questionnaire's items are deemed valid.

3.10 Data Analysis Method

Quantitative data analysis methods are the process of analysing and interpreting numerical data. The researcher gathers data derived from those who participated and then analyzes the numerical data through some methods to identify the relationship between the variables. The researcher gathers information and data in this study from the survey distributed to the target respondents. The data was then analysed using descriptive statistics, Pearson correlation coefficient and multiple regression analysis.

3.10.1 Descriptive Analysis

Descriptive analysis is one method that sorts the research data to help demonstrate and describe the data information. On the other hand, it involves summarizing and exploring data to identify trends, patterns, and relationships. Descriptive analysis summarizes and demonstrates the information data by measuring the frequency, central tendency, and variability. In this study, the researcher applies descriptive analysis to central tendency and dispersion measures.

The central tendency is finding the central position given a set of data. Three measurements will be used to measure the central tendency: mean, median, and mode. It is suitable to use central tendency measures to analyze data under certain conditions.

In this study, the mode and mean are applied to interpret the data in the research. Mode is used to identify the most frequent data within the data set. In the study, the model can show which barrier will significantly influence the adoption of electric vehicles (EVs).

Moreover, mean is the popular central tendency well known to us. Mean is the average of the dataset. It can be calculated by adding all the numbers and dividing by the number of values. In this study, descriptive analysis is implemented to analyze the independent variables (infrastructure barrier, financial barrier, technological barrier, and environmental barrier). The researcher can identify and analyze how respondents perceive Malaysia's barriers to adopting electric vehicles (EVs). The researcher can determine which barriers are most significant to EV adoption from the respondents' perspective by examining the data.

Besides that, the central tendency must be more adequate to demonstrate the data. Thus, to demonstrate the data, measuring the dispersion, which is range, interquartile range, and standard deviation, can extend the variability of the research. The researcher adopts the standard deviation in the study to identify how many individual responses differ from the average.

3.10.2 Pearson Correlation Coefficient

Researchers can determine how strongly the dependent and independent variables are linearly related by using the Pearson correlation coefficient. This study uses Pearson correlation analysis to measure the probability of the correlation for the data collected from the sample.

The correlation coefficient can assume values in the range of (−1) and (+1). An ideal negative relationship between dependent and independent variables corresponds to -1. As the value of one variable goes up, the value of the other variable goes down in a perfectly linear fashion. While +1 indicates perfect correlation in which dependent and independent variables move in the same direction. There is one

variable growing, and as this variable grows the second variable grows perfectly linearly.

Table 3.5: Correlation Coefficient

Scale of correlation coefficient	Value
$0 < r \leq 0.19$	Very Low Correlation
$0.2 \leq r \leq 0.39$	Low Correlation
$0.4 \leq r \leq 0.59$	Moderate Correlation
$0.6 \leq r \leq 0.79$	High Correlation
$0.8 \leq r \leq 1.0$	Very High Correlation

(Sources: Mahiswaran Selvanathan, 2020)

3.10.3 Multiple Regression Analysis

Sun et al. (2023) figures out multiple regression analysis as a statistical technique for simulating the relationship between a variable of dependency and one or more independent variables. It allows researchers to query how clustered independent variables can impact the outcome, to highlight complex interactions that would not be picked up with a single independent variable. It is a good technique for the analysis one dependent variable and multiple independent variables. This study uses multiple regression analysis to examine the relationship between the EV adoption and independent variables of infrastructure, financial, technological and environmental.

3.11 Summary

This chapter discusses the study design, methodology method, data sources, location of research, design of sampling, research strategy, time horizon, scientific canons and data analysis methodologies used to conduct this research. The method

used in this research was quantitative. Surveys are among the primary data sources used in the research, with secondary sources including academic journals, articles, and e-books. In this study, the simple random sampling technique is employed to select a sample from the target population of non-EV owners who hold driver's licenses. A pilot test of 30 sets is performed before distributing the questionnaire to improve its accuracy. The survey questionnaire is then given to approximately 384 respondents for data collection. After that, the previously described statistical procedure was used to evaluate and discuss the data.

CHAPTER 4

DATA ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter analyzes and reviews the responses obtained from the survey questionnaire administered to respondents. Data was collected using Google Forms that were published to non-EV owners with driver's licenses. The data obtained were analyzed with SPSS software. The results of the pilot test were shown first, followed by the response rate. Besides the demographic analysis, descriptive analysis and inferential analysis, which comprised the Pearson correlation analysis and multiple regression analysis. All results were displayed to enhance interpretation, either in pie charts or in table format. An overview was provided at the close of this chapter.

4.2 Pilot Test

A pilot test with 30 respondents was conducted to confirm the questionnaire's reliability and validity before deployment for data collection. Researchers used the pilot test to address potential shortcomings while adding the modifications necessary to enhance the general quality of the questionnaire. This was to guarantee that all of the questions were clear and understandable in the responses.

4.2.1 Validity Test

Table 4.1: Validity Test

Items	Values	Critical Values	Validity Status
BI1	0.828	0.361	Valid
BI2	0.754	0.361	Valid
BI3	0.746	0.361	Valid
BI4	0.842	0.361	Valid
BI5	0.833	0.361	Valid
BF1	0.823	0.361	Valid
BF2	0.652	0.361	Valid
BF3	0.848	0.361	Valid
BF4	0.812	0.361	Valid
BF5	0.862	0.361	Valid
BT1	0.831	0.361	Valid
BT2	0.815	0.361	Valid
BT3	0.721	0.361	Valid
BT4	0.817	0.361	Valid
BT5	0.729	0.361	Valid
BE1	0.475	0.361	Valid
BE2	0.820	0.361	Valid
BE3	0.837	0.361	Valid
BE4	0.806	0.361	Valid
BE5	0.741	0.361	Valid
C1	0.777	0.361	Valid
C2	0.789	0.361	Valid
C3	0.893	0.361	Valid
C4	0.846	0.361	Valid
C5	0.728	0.361	Valid

Table 4.1 presents the validity test result. The researcher conducted a validity test with 30 respondents, testing all 25 items. The results revealed that the items were valid, with values regularly exceeding the critical value of 0.361. This indicated that the questionnaire items were statistically valid and may be used in future analyses.

4.2.2 Reliability Test

Reliability tests in research measure the scale's internal consistency and stability. In this research, the method that was used to test the reliability was Cronbach's Alpha.

Table 4.2: Reliability statistics

Cronbach's Alpha	N of items
0.974	25

Table 4.2 displayed a total of 25 elements that were measured in this research using data gathered from thirty people who participated. The value of Cronbach's Alpha for all the items was 0.974. It indicated that the data obtained was reliable with excellent internal consistency according to the Cronbach's Alpha table stated in Chapter 3.

4.3 Respondents Rate

Table 4.3: Rate of Response

Category	Total	Percent (%)
Total Responses	408	100.0%
Non-Target Responses	24	5.88%
Valid Responses	384	94.12%

The researcher distributed the questionnaire online to people who were non-EV owners and had a driver's license, living in Malaysia, through online methods. In

this survey, a total number of 408 (100.0%) responses were initially collected. After examination, the researcher determined that 24 (5.88%) responses were not the target responses. After filtering, only 384 (94.12%) responses were valid to be used in the research, while the 24 responses were excluded from the study.

4.4 Demographic Analysis

Demographic analysis provided an overview of the respondents' characteristics from different backgrounds. The analysis included age, gender, race, state of origin, education level, occupation, monthly income, vehicle ownership, driving license status, vehicle type, car brand, vehicle usage frequency, familiarity with Electric Vehicles (EVs), future intentions for EV ownership (1-5 years), awareness of EV policies and incentives, and familiarity with EV brands.

4.4.1 Age Range

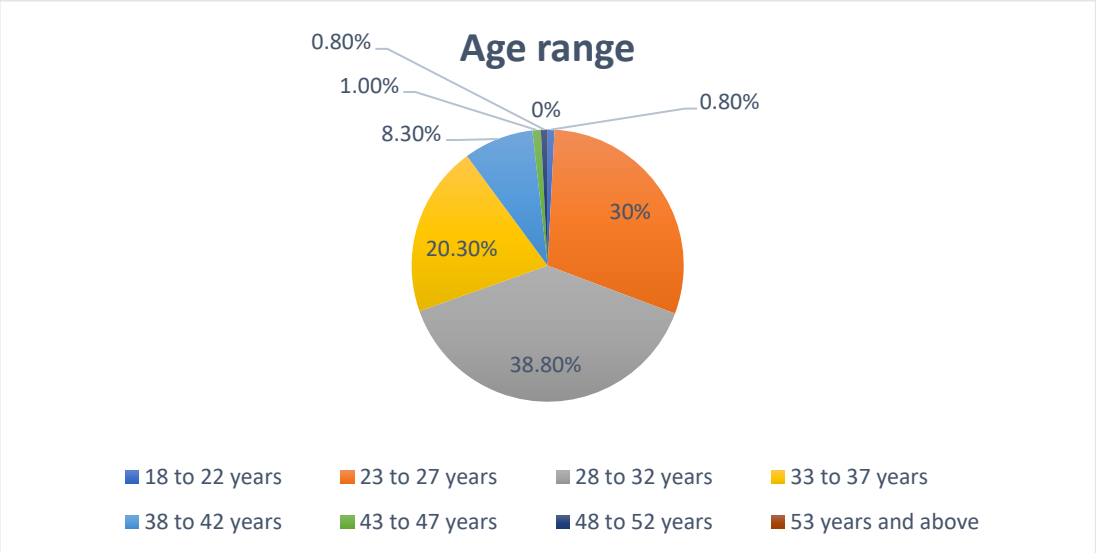


Figure 4.1: Age Range

Figure 4.1 displayed the age range of the respondents, with the majority falling within the 28 to 32 years range, accounting for 38.80% of the total respondents. This was followed by the 23 to 27 years range, comprising 29.90% of respondents. The 33 to 37 years range accounted for 20.30%, while the 38 to 42 years range was 8.3%. Meanwhile, the 43 to 47 years group represented 1%, and the lowest proportion of respondents was in the 18 to 22 years and 48 to 52 years groups, each accounting for 0.8%. There were no respondents in the 53 years and above age range.

4.4.2 Gender

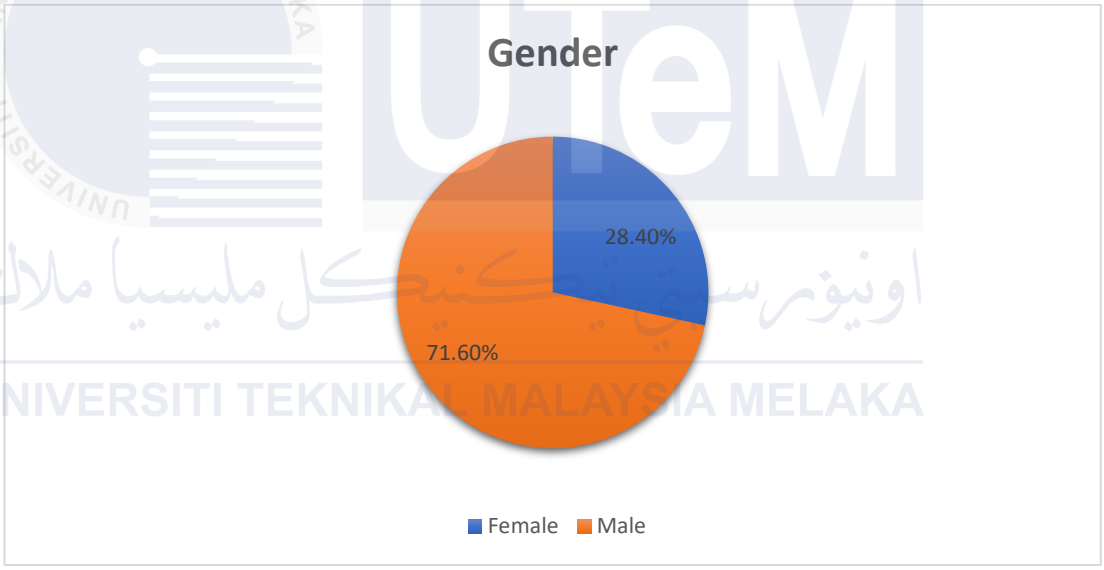


Figure 4.2: Gender

Figure 4.2 presented the gender composition of the respondents in this research. Out of the 384 respondents, the majority were male, accounting for 71.60% of the total, while the remaining 28.40% were female. The higher percentage of male respondents reflected that males were more likely to be interested in vehicle-related topics.

4.4.3 Race

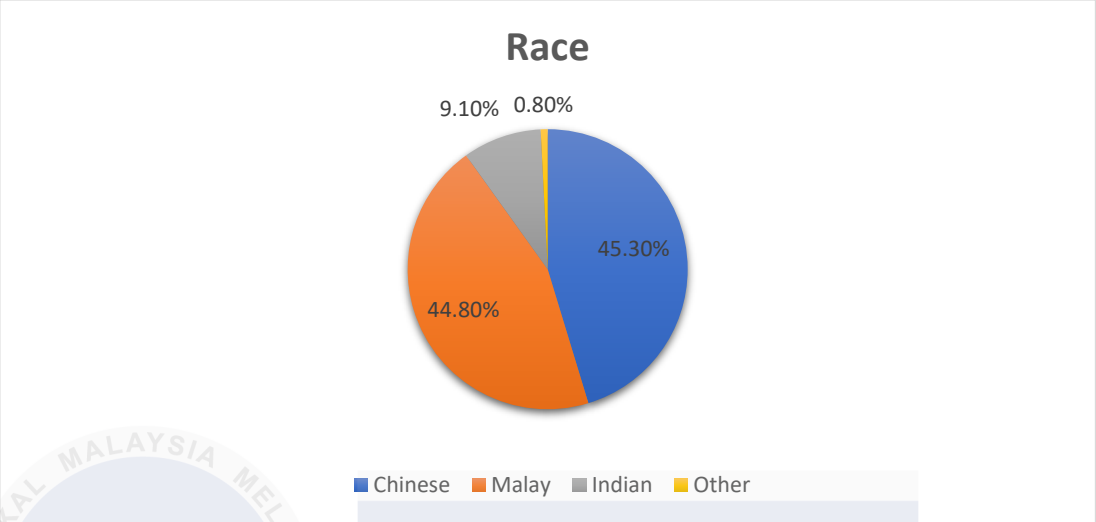


Figure 4.3: Race

The above Figure 4.3 showed the race of the respondents from 384 respondents. The majority of the respondents were Chinese, comprising 45.3%, followed by the Malay respondents, which was 44.8%. The Indian respondents accounted for 9.10%, and the least majority was the other race, representing only 0.8%.

4.4.4 State of Origin

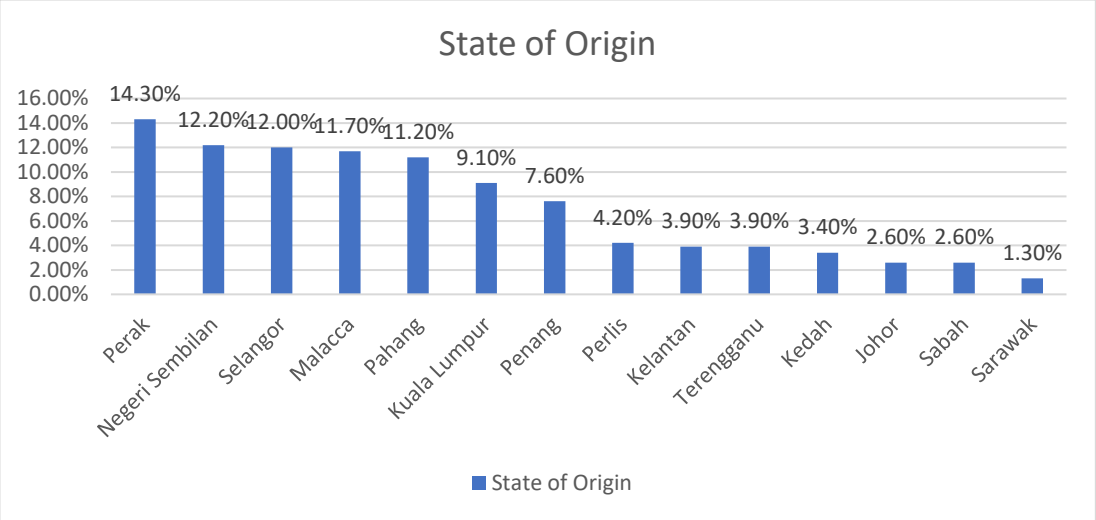


Figure 4.4: State of Origin

Figure 4.4 exhibited the state of origin of the respondents in the research. The largest proportion of the respondents were from Perak, comprising 14.3% of the total respondents, followed by respondents from Negeri Sembilan, who made up 12.2%, and Selangor with 12%. In addition, Malacca accounted for 11.7% of respondents, while Pahang comprised 11.2%. Meanwhile, respondents from Kuala Lumpur also made up 9.1%, and Penang represented 7.6% of the total. Perlis, Kelantan, Terengganu, and Kedah contributed smaller proportions, with Perlis at 4.2%, Kelantan and Terengganu at 3.9%, and Kedah at 3.4%. The states with the lowest proportion of respondents were Johor, Sabah, and Sarawak. Johor and Sabah both accounted for 2.6%, while Sarawak accounted for 1.3%.

4.4.5 Education Level

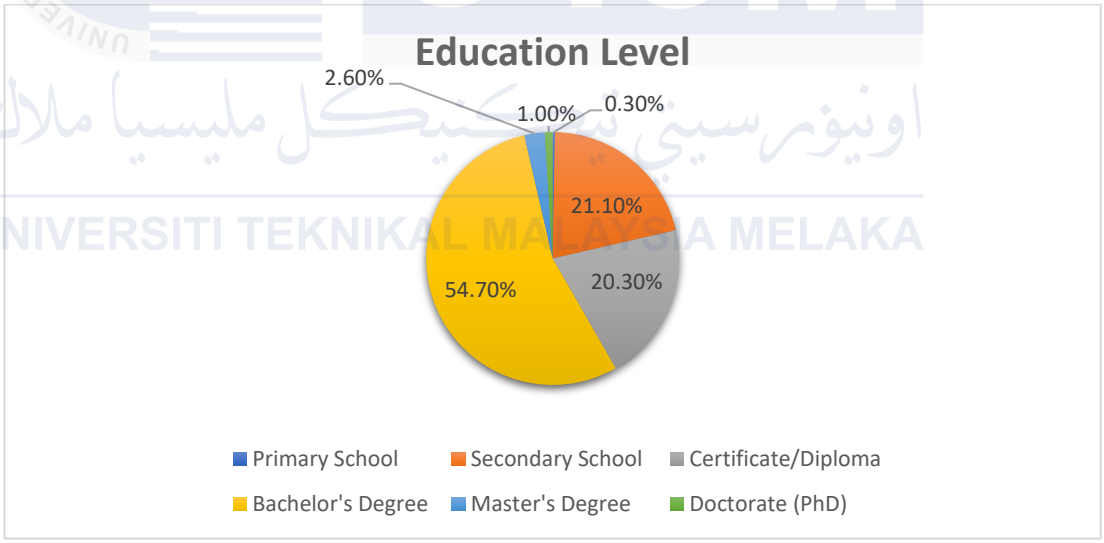


Figure 4.5: Education Level

Figure 4.5 exhibited the respondents' education level among 384 respondents. Almost every respondent who submitted held a bachelor's degree, accounting for 54.7%. This was followed by Secondary School holders, comprising 21.1%, and those with a certificate or diploma, who made up 20.3%. In addition, the results revealed that 2.6% of respondents held a master's degree, while 1% held a doctorate (PhD). The smallest group, primary school holders, recorded only 0.3%.

4.4.6 Occupation

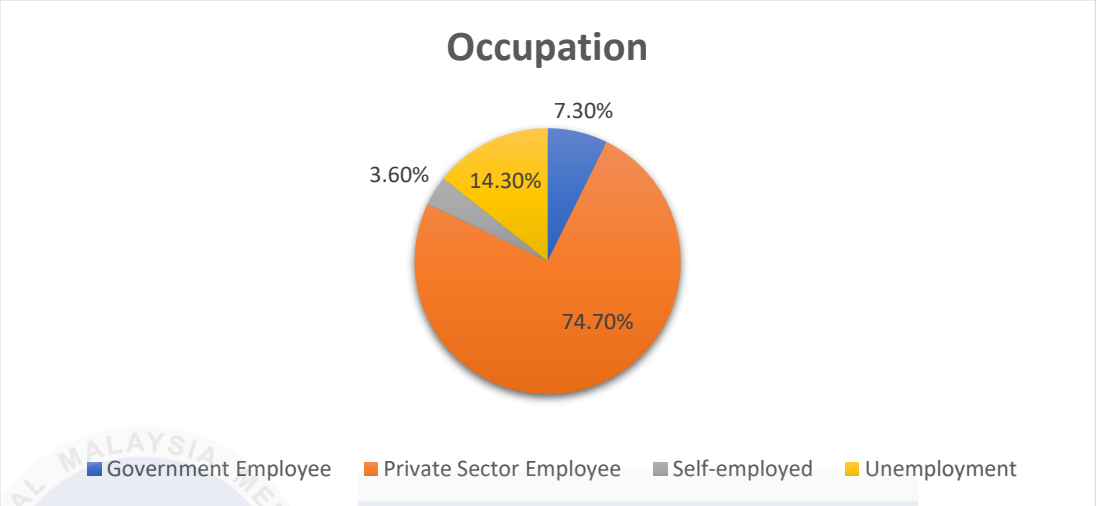


Figure 4.6: Occupation

Figure 4.6 presented the occupation of the respondents. A significant percentage of respondents were private sector employees, comprising 74.7% of the total respondents. This was followed by unemployed respondents, who accounted for 14.3%. Additionally, government employees made up 7.3%, while the smallest group of respondents were self-employed, representing only 3.6%.

4.4.7 Monthly Income

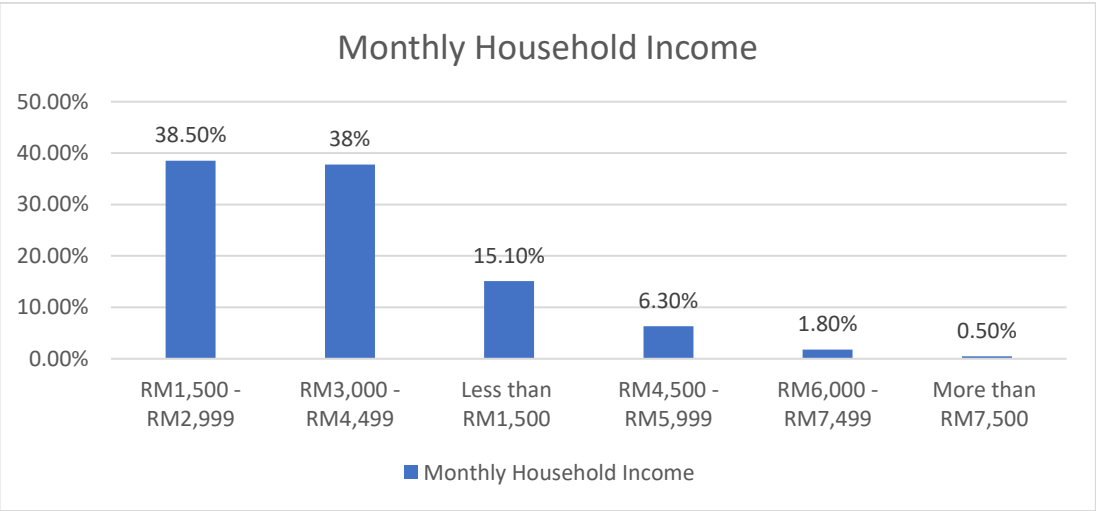


Figure 4.7: Monthly Income

Figure 4.7 illustrated the monthly household income of the 384 respondents. The largest group of respondents fell within the income range of RM1,500 to RM2,999, accounting for 38.5%. This was followed by respondents with an income range of RM3,000 to RM4,499, comprising 37.8%. Household incomes of less than RM1,500 accounted for 15.1%. Meanwhile, 6.3% of respondents reported incomes of RM4,500 to RM5,999, and a smaller percentage of respondents earned RM6,000 to RM7,499 (1.8%). The least represented group were respondents with a monthly income of more than RM7,500, contributing only 0.5%.

4.4.8 Vehicle Ownership

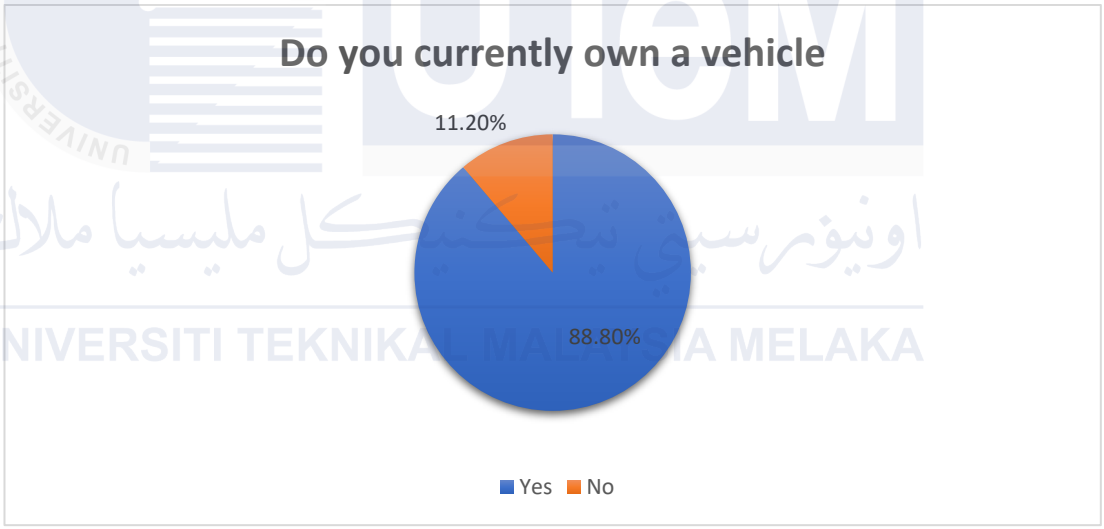


Figure 4.8: Vehicle Ownership

Based on Figure 4.8, it illustrated the vehicle ownership status of the 384 respondents. The large number of the respondents, comprising 88.8%, reported that they currently owned a vehicle. In contrast, a smaller group, comprising 11.2%, indicated that they did not own a vehicle. This showed that most respondents were vehicle owners, highlighting the relevance of vehicle ownership in understanding potential barriers and opportunities for electric vehicle adoption among the target group.

4.4.9 Driving License Status

Figure 4.9: Driving License Status

Figure 4.9 displayed the driving license status of the 384 respondents. Since the target respondents of this research were non-EV owners with a driver's license, all of the respondents, accounting for 100%, reported that they possessed a valid driving license.

4.4.10 Vehicle Type

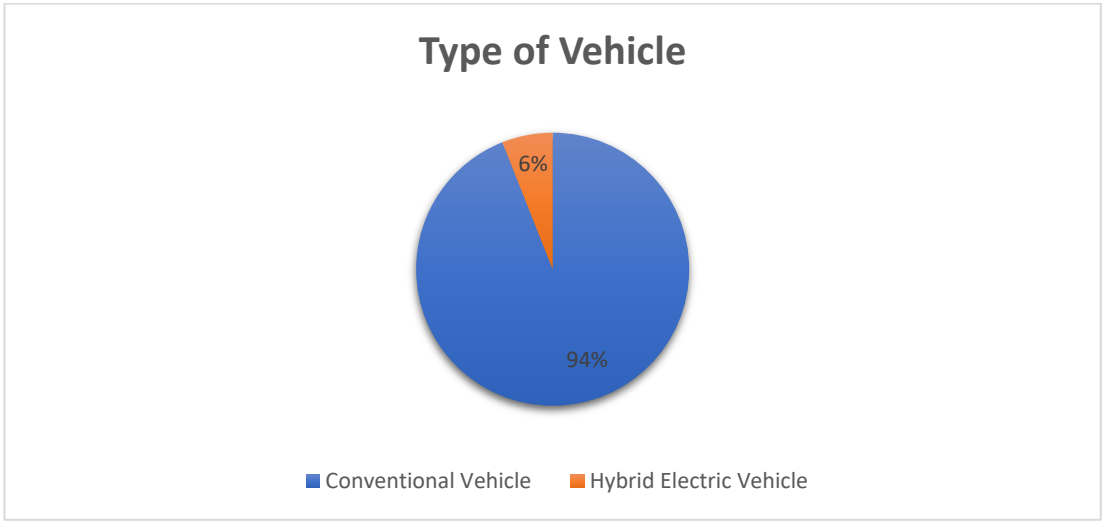


Figure 4.10: Vehicle Type

Based on Figure 4.10, most of the respondents owned conventional vehicles, comprising 94%. Meanwhile, hybrid electric vehicle owners accounted for only 6% of the total respondents. This indicated that conventional vehicles remained the dominant choice among the respondents and had a broader potential for transitioning toward electric vehicles.

4.4.11 Car Brand

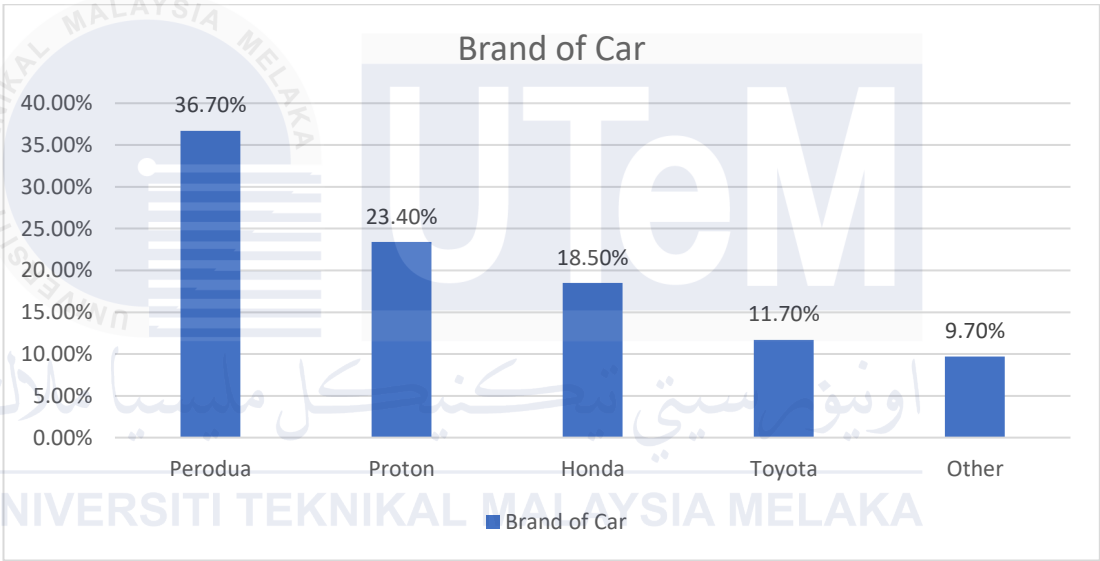


Figure 4.11: Car Brand

Figure 4.11 presented the car brands owned by the respondents. Among the 384 respondents, the majority owned Perodua vehicles, accounting for 36.7%. This was followed by Proton, which made up 23.4%, while Honda comprised 18.5% of respondents. Meanwhile, 11.7% of respondents owned Toyota vehicles, and the remaining 9.7% owned vehicles from other brands, such as Nissan, Audi, BMW, Hyundai, Kia, and others.

4.4.12 Vehicle Usage Frequency

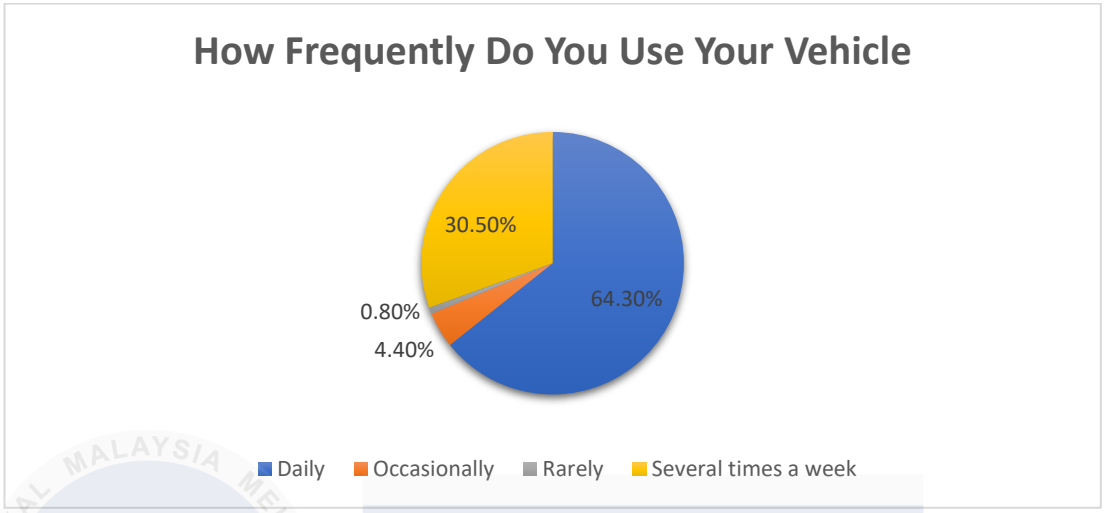


Figure 4.12: Vehicle Usage Frequency

Figure 4.12 presented the frequency of vehicle usage among the respondents. The majority of respondents reported using their vehicles daily (64.3%), making it the most common usage frequency. This was followed by respondents who used their vehicles several times a week, accounting for 30.5%. Additionally, 4.4% of respondents used their vehicles occasionally. The smallest group of respondents reported that they rarely used their vehicle, comprising 0.8%.

4.4.13 Familiarity with Electric Vehicles (EVs)

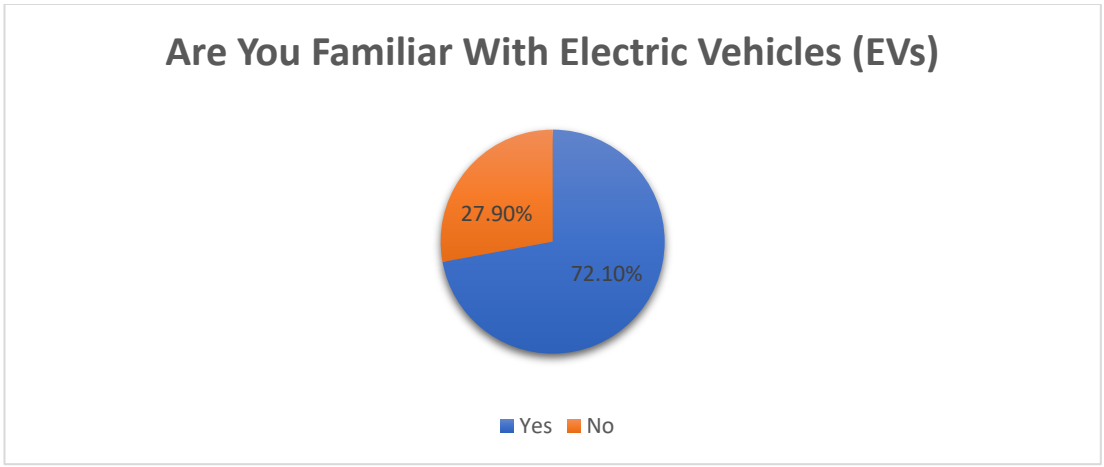


Figure 4.13: Familiarity with Electric Vehicles (EVs)

Figure 4.13 presented the familiarity of respondents with electric vehicles (EVs). Among the respondents, 72.1% reported being familiar with electric vehicles, indicating a relatively high level of awareness about EVs. On the other hand, 27.9% of respondents were not familiar with electric vehicles, reflecting a smaller portion of the population who may require awareness efforts regarding EVs.

4.4.14 Future Intention for EV Ownership (1-5 Years)

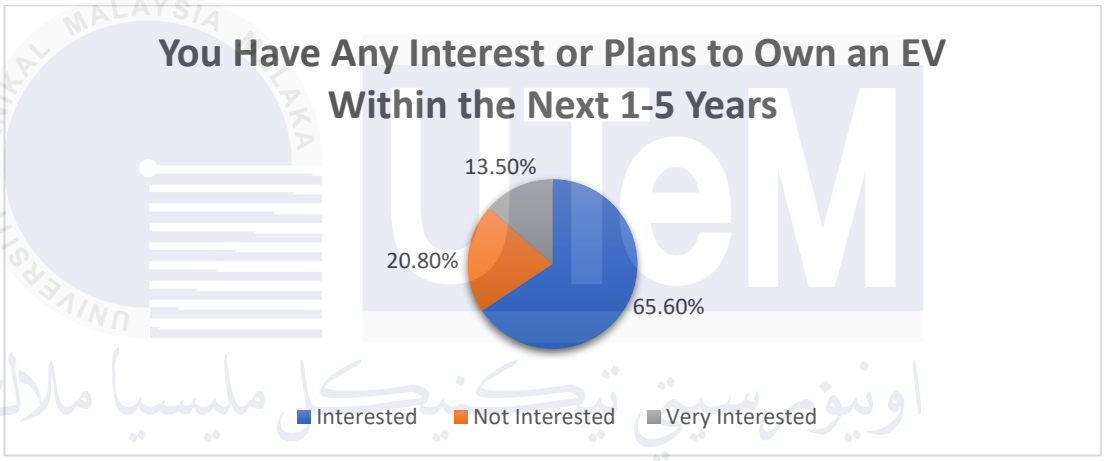


Figure 4.14: Future Intention for EV Ownership (1-5 Years)

Figure 4.14 presented the respondents' interest in owning an electric vehicle (EV) within the next 1-5 years. The majority of respondents, 65.6%, expressed interest in owning an EV in the future, followed by 13.5% of the respondents who were very interested in making the transition to an EV. Meanwhile, 20.8% of respondents were not interested in owning an EV within the next 1-5 years.

4.4.15 Awareness of EV Policies and Incentives

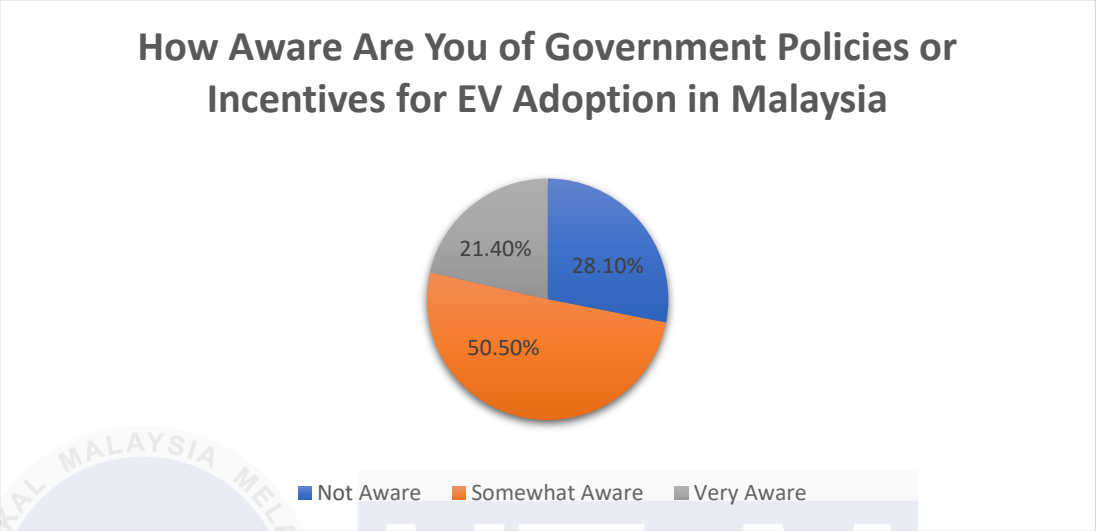


Figure 4.15: Awareness of EV Policies and Incentives

Based on Figure 4.15, a significant amount of the respondents were somewhat informed of the government policies or incentives, comprising 50.5%. This was followed by 28.1% of respondents who were not aware of the policies or incentives. In addition, the respondents who were very aware of the incentives or policies were the least, comprising only 21.4%.

4.4.16 Familiarity with EV Brands

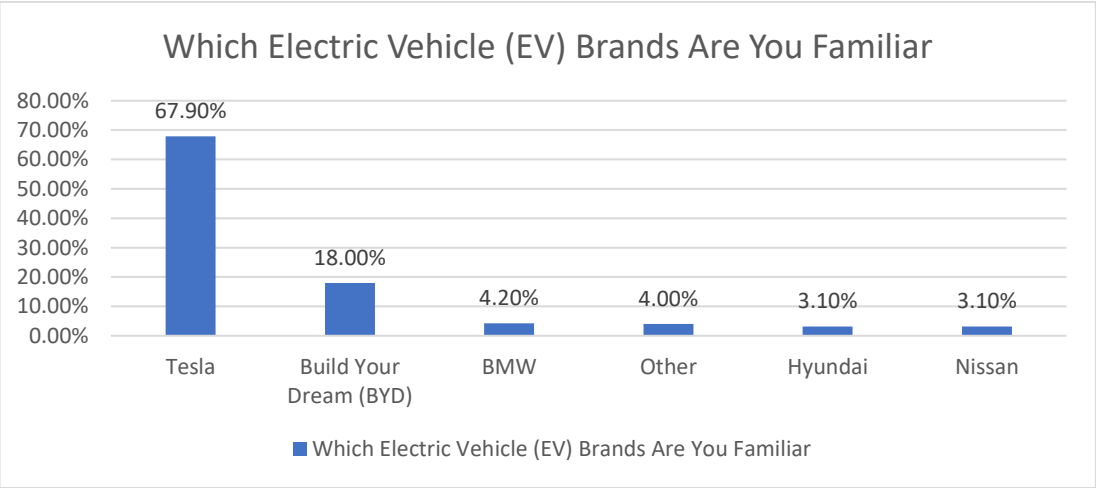


Figure 4.16: Familiarity with EV Brands

The above figure 4.16 shows 6 categories of electric vehicle brands that are familiar to respondents. The most recognized EV brand among the respondents is Tesla, comprising 67.90%. This was followed by the Build Your Dream (BYD) brand, which accounted for 18% of respondents. Meanwhile, the remaining car brands only had a small proportion, with BMW (4.2%), Nissan (3.1%), and Hyundai (3.1%). The remaining 4% of the respondents were familiar with Audi, Kia, Volvo, and Chery.

4.5 Descriptive Analysis

In this research, the researchers summarized and interpreted data to describe the respondents' perceptions regarding each variable through statistical techniques. The data was presented using measures such as means and standard deviations.

Table 4.4: Descriptive analysis of the independent variable for twenty items

Variable	Factors	Mean	Standard Deviation	n
Infrastructure (IV1)	I1	4.39	0.599	384
	I2	4.53	0.582	384
	I3	4.36	0.580	384
	I4	4.37	0.599	384
	I5	4.40	0.626	384
Financial (IV2)	F1	4.38	0.613	384
	F2	4.35	0.645	384
	F3	4.36	0.634	384
	F4	4.34	0.621	384
	F5	4.33	0.607	384
Technological (IV3)	T1	4.36	0.588	384
	T2	4.50	0.650	384
	T3	4.40	0.610	384
	T4	4.29	0.578	384
	T5	4.32	0.646	384
Environmental (IV4)	E1	4.36	0.576	384

	E2	4.39	0.594	384
	E3	4.34	0.606	384
	E4	4.36	0.584	384
	E5	4.36	0.598	384

Table 4.4 illustrated the statistically measured mean, standard deviation, and sample size for the independent variables, which are infrastructure (IV1), financial (IV2), technological (IV3), and environmental (IV4). The total sample size for this study was 384 respondents.

The findings revealed that infrastructure (IV1) had scored the mean ranging between 4.36 and 4.53, which showed a substantial number of the respondents strongly concurred with the statement under infrastructure. Item I2 scored the highest mean (4.53) and the standard deviation for I2 was 0.582. This reflected less variability of the perception among the respondents. The standard deviation for all the items under infrastructure ranged between 0.580 and 0.626, demonstrating that the data were close to the means.

In addition, for financial (IV2), the mean was relatively low compared to others, with the means scoring between 4.33 and 4.38. It showed that the respondents agreed that the financial aspect influences the adoption of EVs. Item F1 scored the highest mean (4.38), and the standard deviation was 0.613, showing a good level of reliability in the responses. The standard deviation for financial ranged between 0.607 and 0.645, demonstrating a moderate level of variability.

Furthermore, the technological variable presented means scoring between 4.29 and 4.50. It showed that respondents strongly agreed with the questions. Item T2 recorded the highest mean score (4.50), and the standard deviation was 0.650, demonstrating that the item was relatively variable compared to other items.

Lastly, the environmental (IV4) exhibited mean scores ranging between 4.34 and 4.39, which showed the respondents generally agreed with the questions. The means of all items were very close for each item under this variable. Besides that, the

standard deviation ranged between 0.576 and 0.606, indicating that most of the respondents agreed that environmental aspects influence EV adoption.

Table 4.5: Descriptive analysis for independent and dependent variables

Variables	Mean	Standard Deviation	N
Infrastructure (IV1)	4.4109	0.37602	384
Financial (IV2)	4.3500	0.41587	384
Technological (IV3)	4.3755	0.40042	384
Environmental (IV4)	4.3646	0.38319	384
Electric Vehicle (EV) Adoption (DV)	4.3708	0.38481	384

Table 4.5 illustrates the means and standard deviation for the independent variables and dependent variables, namely infrastructure (IV1), financial (IV2), technological (IV3), environmental (IV4), and electric vehicle adoption (DV). The results revealed that all of the variables scored a mean above 4.0, suggesting that most of the respondents concurred that each independent variable influences the adoption of EVs in Malaysia. The infrastructure (IV1) scored the highest mean (4.4109) among the other independent variables, showing that infrastructure is significant in influencing electric vehicle adoption. Meanwhile, the standard deviation presented a low standard deviation among the independent and dependent variables, which ranged between 0.37602 and 0.41587. It indicated the scores were concentrated around their mean.

4.6 Inferential Statistics

Inferential statistics is a tool that is usually used to make a prediction and describe a population using the data gathered through a sample. In this research, the researcher employed Pearson correlation to measure the strength of the linear relationship between two variables and multiple regression analysis to investigate the correlation between a single dependent variable and several independent variables.

4.6.1 Pearson's Product Moment Correlation Coefficient (PMCC)

This research used Pearson's Product Moment Correlation Coefficient (PMCC) to assess the strength of the linear correlation between the dependent and independent variables. This study used Pearson correlation analysis to calculate the probability of the correlation for the data gathered from the population being studied. The scale of the correlation coefficient was referred to the Table 3.5 provided in the previous chapter.

Table 4.6: Pearson Correlation Analysis

Independent Variables	Correlation Values	Significant	N
Infrastructure (IV1)	0.685	0.001	384
Financial (IV2)	0.758	0.001	384
Technological (IV3)	0.753	0.001	384
Environmental (IV4)	0.791	0.001	384

Table 4.6 showed the correlation values for each independent variable, such as infrastructure (IV1), financial (IV2), technological (IV3), and environmental (IV4), with the dependent variable, which was electric vehicle (EV) adoption in Malaysia, based on the sample size of 384 respondents.

The outcome showed a correlation of the four independent variables infrastructure (IV1), financial (IV2), technological (IV3), and environmental (IV4) between 0.685–0.791. According to Table 3.5 in Chapter 3, the correlation range was mentioned as the correlation of $0.6 \leq r \leq 0.79$ indicates a high correlation. This implies that the linear relationship between the four barriers and the electric vehicle adoption (EV) was a strong correlation. Therefore, the four null hypotheses (H0) were rejected, and the alternative hypothesis (H1) was accepted.

4.6.2 Multiple Regression Analysis

The researcher used multiple regression analysis to identify the relationship between a dependent variable (electric vehicle (EV) adoption in Malaysia) and four independent variables (infrastructure (IV1), financial (IV2), technological (IV3), and environmental). It helped the researcher to identify how each of the four independent variables influenced electric vehicle (EV) adoption in Malaysia.

Table 4.7: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.853	0.727	0.724	0.20201

a. Predictors: (Constant), Environmental, Infrastructure, Financial, Technological

b. Dependent Variable: Electric Vehicle (EV) Adoption

Table 4.7 showed the result for the model summary of this research. The R-value was 0.853, indicating a strong positive relationship between the independent variables (environmental, infrastructure, financial, and technological) and the dependent variable (electric vehicle (EV) adoption). Meanwhile, the coefficient of determination (R-square) was 0.727, reflecting that 72.7% of the variation in electric vehicle (EV) adoption could be explained by environmental, infrastructure, financial, and technological predictors.

Table 4.8: Coefficient

Model		Unstandardized Coefficient B	Significant
1	(Constant)	0.235	0.081
	Infrastructure (IV1)	0.201	0.001
	Financial (IV2)	0.208	0.001
	Technological (IV3)	0.157	0.001
	Environmental (IV4)	0.380	0.001

a. Dependent Variable: (Electric Vehicle (EV) Adoption)

The coefficient table provided the unstandardized coefficient (B) and significance for each independent variable in the model. Table 4.8 revealed the impact of IV1, IV2, IV3, and IV4 on the electric vehicle (EV) adoption. The unstandardized coefficient indicated how a one-unit increase in predictors would affect electric vehicle adoption.

Based on the coefficient from the Table 4.8, the linear regression equation was developed as below:

$$Y = 0.235 + 0.201 (IV1) + 0.208 (IV2) + 0.157 (IV3) + 0.380 (IV4)$$

Where Y = Electric Vehicle (EV) Adoption
IV1 = Infrastructure
IV2 = Financial
IV3 = Technological
IV4 = Environmental

Although the constant in the research was not statistically significant, it was included in the linear equation to maintain the accuracy of the regression model. The constant provided a correct baseline for the predictions. The findings showed that a one-unit increase in IV1 resulted in a 0.201 increase in electric vehicle (EV) uptake. Furthermore, a one-unit rise in IV2 resulted in a 0.208 increase in electric vehicle adoption, and a one-unit increase in IV3 resulted in a 0.157 increase in EV adoption. Finally, a one-unit rise in IV4 resulted in an increase of 0.380 in EV adoption.

In this context, IV4 had the greatest influence on electric vehicle (EV) adoption with a coefficient of 0.380, although IV1 (0.201) and IV2 (0.208) had a significant positive influence on EV adoption. IV3 had a smaller impact, with a value of 0.157. All the predictors were highly significant as their p-values were below 0.05.

4.6.3 Summary of Hypotheses

Hypothesis 1: Infrastructure

H_0: There is no significant relationship between infrastructure and the adoption of electric vehicles (EVs).
H_1: There is a significant relationship between infrastructure and the adoption of electric vehicles (EVs).

Based on Table 4.6, the result of the correlation value for infrastructure (IV1) was 0.685, and the significance was 0.001. Since the significance of infrastructure (IV1) was less than 0.05, it showed that infrastructure (IV1) had a significant relationship with electric vehicle (EV) adoption. Therefore, the researcher selected the alternative hypothesis (H_1).

Hypothesis 2: Financial

H_0: There is no significant relationship between financial and adopting electric vehicles (EVs).
H_1: There is a significant relationship between financial and electric vehicle (EV) adoption.

Based on Table 4.6, the result of the correlation value for financial (IV2) was 0.758, and the significance was 0.001. Since the significance of financial (IV2) was less than 0.05, it showed that financial (IV2) had a significant relationship with electric vehicle (EV) adoption. Therefore, the researcher selected the alternative hypothesis (H_1).

Hypothesis 3: Technological

H_0: There is no significant relationship between technological and adopting electric vehicles (EVs).
H_1: There is a significant relationship between technological and electric vehicle (EV) adoption.

Based on Table 4.6, the result of the correlation value for technological (IV3) was 0.753, and the significance was 0.001. Since the significance of technological (IV3) was less than 0.05, it showed that technological (IV3) had a significant relationship with electric vehicle (EV) adoption. Therefore, the researcher selected the alternative hypothesis (H_1).

Hypothesis 4: Environmental

H_0: There is no significant relationship between the environmental and adopting electric vehicles (EVs).

H_1: There is a significant relationship between the environmental and adopting electric vehicles (EVs).

Based on Table 4.6, the result of the correlation value for environmental (IV4) was 0.791, and the significance was 0.001. Since the significance of environmental (IV4) was less than 0.05, it showed that environmental (IV4) had a significant relationship with electric vehicle (EV) adoption. Therefore, the researcher selected the alternative hypothesis (H_1).

Table 4.9: Summary of Hypotheses

Hypothesis	Decision
H_1: There is a significant relationship between infrastructure and the adoption of electric vehicles (EVs).	Accept
H_2: There is a significant relationship between financial and electric vehicle (EV) adoption.	Accept
H_3: There is a significant relationship between technological and electric vehicle (EV) adoption.	Accept
H_4: There is a significant relationship between the environmental and adopting electric vehicles (EVs).	Accept

4.7 Summary

This chapter provided the data, the analytic method, and the discussion of individual 384 respondents' data. Also, a pilot test was carried out to evaluate the feasibility, reliability, and validity of the research instrument. The study employed demographic, multiple linear regression, descriptive, and Pearson correlation analyses. A demographic analysis provided specific details about the backgrounds of the respondents, in terms of age, gender, income, race, state of origin etc. On the other hand, descriptive analysis displayed the information used statistical methods: mean, with standard deviation. The linear correlation between independent factors and the dependent variable was found by using Pearson correlation. A dependent variable was tested to be associated with more than one independent variables using multiple regression analysis.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

The researcher discussed the conclusions that were drawn on the basis of the findings of the previous chapter. In this chapter also elaborated on the results by a discussion of the objectives, implications, limitations, and some suggestions for additional study.

5.2 Summary of the findings

This chapter answers to the research objectives provided in Chapter 1. The subsequent paragraphs delve into the findings in depth, alluding to how the findings corresponded to the research objectives and key takeaways from the analysis.

5.2.1 Research Objective 1: To analyze the most significant barriers to the adoption of EVs in Malaysia.

The association of electric vehicles (EV) independent variables was discovered through multiple regression analysis in the prior study results. Then ranked the independent variable based on the beta value (B).

Table 5.1: Ranking of Factor

Items	Unstandardized Coefficient B	Rank
Environmental	0.380	1
Financial	0.208	2
Infrastructure	0.201	3
Technological	0.157	4

Table 5.1 showed the rankings of four independent variables: environmental, financial, infrastructure, and technological. Higher beta value (B) indicated a stronger correlation between the independent variable and EV adoption. The results indicated that the environmental factor had the highest beta value (0.380). Environmental concerns emerged as the most relevant factor impacting EV adoption in Malaysia. The results showed that Malaysians had taken the initiative to protect the environment. In a survey, respondents indicated they believe EVs can mitigate global warming and create a better environment, and that they would consider electric vehicles when purchasing a new car. The policymakers should come out the environmental laws that are meant to curb climate change by lowering emissions of carbon in both transportation and energy industries.

The results were similar with previous study that discovered environmental concerns had a significant effect in the adoption of electric vehicles (EVs) (Mustafa et al., 2024). There were conservationists actively conserving the environment, for people understood the environment was changing. However, results were contrary to Pamidimukkala et al. (2023), who found the environmental barrier was small for electric car uptake in the United States. Likewise, it also contradicted by Austmann and Vigne's (2021) research, which stated that environmental awareness had no effect

in implementing electric vehicles. Cultural differences between Malaysia and other countries could have affected the result.

5.2.2 Objective 2: To identify the barriers influencing the adoption of electric vehicles (EVs) in Malaysia.

The researcher explained the second objective of the research in Chapter 1, which was aimed to identify the barriers influencing the adoption of electric vehicles (EVs) in Malaysia. In order to reach this research objective, descriptive analysis was applied by the researcher. In previous studies such as Kongklaew et al. (2021), Pamidimukkala et al. (2023), and Tsai et al. (2024) identified the infrastructure barriers, such as limited public charging infrastructure and few maintenance and repair services, impact individual conversions to EVs. This highlighted that the federal government and industry need to enhance infrastructure for charging to reduce the uncertainty and anxiety of electric vehicle owners.

Infrastructure had a mean score of 4.4109 and a standard deviation of 0.37602. It indicated that respondents perceived infrastructure as an influential factor in the deployment of electric cars (EVs) in Malaysia. It shows that infrastructure such as charging stations, maintenance services, and other facilities are important for the uptake of electric vehicles in Malaysia. These results are in line with previous work undertaken by Asadi (2022), who concluded that infrastructure for charging has a significant effect on the uptake of EVs in Malaysia.

Additionally, the financial mean score of 4.3500 with a low standard deviation score of 0.41587 implies that financial factors such as the resale value of the car, battery replacement, and maintaining a car successively also play an important part in facilitating the uptake of EVs in Malaysia. Findings from previous studies were similar. For instance, Pamidimukkala et al. (2023) found that consumers are price-sensitive and have increased apprehensive due to high beginning pricing.

Moreover, technological with a mean of 4.3755 and a standard deviation of 0.40042 was another determinant. Such as battery durability and life, charging time of EVs and compatibility of the charging station. This result was consistent with Roy et al. (2022) study showing that long charging times are a barrier to EV adoption.

Furthermore, environmental, with a mean score of 4.3646 and a standard deviation of 0.38319, was seen as a determinant of EV adoption. The aspects included battery disposal methods, eco-friendly battery production, and motivation to protect the environment. Based on the data above, the researcher concluded that all four determinants had been identified as factors in the uptake of electric vehicles in Malaysia.

5.2.3 Objective 3: To determine the relationship between each barrier towards EV adoption in Malaysia.

The researcher outlined the research objective: to determine the relationship between each barrier towards EV adoption in Malaysia. To achieve this research objective, the researcher adopted Pearson correlation analysis to evaluate the relationship between the independent variables (infrastructure, financial, technological, and environmental) and the dependent variable (electric vehicle (EV) adoption). Based on Table 4.6, the result demonstrated that all four determinants had a high positive relationship with electric vehicle (EV) adoption in Malaysia. The correlation values ranged from 0.685 to 0.791, and the significance value for all variables was less than 0.05. Therefore, the alternative hypothesis for all variables was accepted.

At first, infrastructure strongly correlated with electric vehicle (EV) adoption. It suggested that more charging stations and maintenance facilities lead to the uptake of electric vehicles (EVs). The finding matched with other studies. A previous study by Pamidimukkala et al. (2023) also demonstrated that infrastructure plays a substantial role in the intention to adopt EVs. Kongklaew et al. (2021) supported this conclusion, finding a significant effect of the lack of public infrastructure on EV adoption in Thailand. The uniform type of charging as well as the convenience of the

infrastructure played a crucial role in encouraging EV adoption. This means that the policymakers must focus on increasing the number of recharging points along with their placement and infrastructural networks. Tsai et al. (2024) highlighted that the overwhelming majority of EV owners are concerned about the number of charging stations and concluded that perhaps the single most important factor when it comes to EV adoption is infrastructure. Murugan and Marisamynathan (2022) showed existing charging stations were inadequate and poorly located to facilitate electric vehicle adoption in India. Thus, it showed that having public charging infrastructure available was a key factor in people transitioning to EVs.

In addition, financial had a positive strong relationship with EV adoption in Malaysia. Tsai et al. (2020) stated that maintenance cost, battery replacement cost and service and maintenance canters were larger for EV owners than non-EV owners. It became clear that finances played a huge role in EV take-up. Other than that, Pamidimukkala et al. and (2023) emphasize that these financial conditions have the most significant impact on EV adoption because respondents are sensitive to price and would consider adopting an EV when the total cost of purchase is lower. Policymakers can implement policies to make electric vehicles more affordable. Ruoso and Ribeiro (2022) support this statement by stating that an electric vehicle has a higher purchase price compared to a conventional vehicle, indicating that financial support is necessary to substitute conventional vehicles.

Third, there was a significant relationship between technological and electric vehicle adoption. Technological factors like the endurance and life of the batteries, the compatibility of charging stations, and charging times were vital in motivating EV adoption. Pamidimukkala et al. (2023) showed that technology played an important role in electric vehicle adoption showing that challenges like the restricted range for driving and lengthy recharge time needed to be solved promptly. Both government and industry should work on solving its battery technology issue to encourage the uptake of electric vehicles. The finding was also consistent with the study by Xue et al. (2024) remarked that the industry needs to advance the technology to reduce the risks associated with EVs. On the other hand, the government can encourage innovation and lower the cost of EVs by supporting the industry in research and development (R&D) in EVs.

The environmental factors were significant in influencing the uptake of electric vehicles (EVs). The conclusion drawn matches up with research executed by Mustafa et al. (2024), where environmental awareness was important in determining use of electric vehicles in China. Similarly, Kongklaew et al. (2021) found environmental awareness is significant in encouraging respondents to adapt to EV adoption. The result supported by Kuo et al. (2022), found that individuals with pro-environmental tendencies were more likely to adopt EVs than individuals without pro-environmental tendencies. However, research conducted by Pamidimukkala et al. (2023) highlighted that people remained concerned about the environmental consequences of battery production and disposal of EV batteries. Meanwhile, Asadi et al. (2021) indicated that consumer awareness of electric vehicle benefits should be encouraged by the government to positively impact the Malaysian context towards the uptake of EVs.

5.3 Implication of Study

The outcomes of this research will assist policymakers and industry stakeholders with a strong grasp of the various aspects influencing the uptake of electric cars (EVs) in Malaysia. It shows also that electric vehicle (EV) uptake is significantly influenced by infrastructure, financial, technological, and environmental. It provides a clear understanding for the policymakers and industry stakeholders to focus on addressing barriers to further enhance the adoption of electric cars (EVs).

The results show that the environmental is the greatest factor influencing the uptake of electric cars in Malaysia. These findings add to the existing research model of electric car adoption and sustainability in Malaysia. The result differs from other developed countries, including the United States, where the environmental is not the critical determinant to the adoption of electric cars. These study results show that the environmental is an important determinant of Malaysian consumers' adoption of electric vehicles.

Moreover, policymakers and industry stakeholders play a significant role in promoting the uptake of electric cars (EVs). The results also identified barriers that influence EV adoption and should be addressed by the efforts of policymakers and stakeholders. For environmental factors, there is a need to start an environmental awareness campaign in this regard and make people understand the role of electric vehicles in sustainability. This will greatly influence the public's understanding of electric automobiles.

Other than that, the infrastructure is a key factor in electric vehicle (EV) adoption, not just for Malaysia but across developed nations. Therefore, more public infrastructure and grid networks must be established throughout the country. Policymakers can work with private companies to place more charging stations in city planning. Moreover, the charging stations with the same brand should be standardized to provide convenience for consumers.

Additionally, the financial aspect is the other key determinant of the acceptance of electric cars (EVs). The initial cost of purchase can be made less burdensome by policymakers making monetary incentives such as subsidies and tax exemptions available to people who purchase such electric vehicles. Financial institutions can also give affordable financial packages like low-interest rates to EV buyers.

5.4 Limitations of the Study and Recommendations for Future Studies

Some limitations in this study can be used as a guide in future research. First, the geographic scope of this research was based on people in cities, which inevitably means the exploration of the attitude of the consumers in the non-urban areas was not completely reflected in this research. Since rural areas may potentially yield different findings in terms of charging infrastructure and range anxiety, future research could broaden the respondents' sampling frames to include rural resident respondents for a more in-depth understanding of electric cars (EV) adoption in Malaysia.

Second, this research sample consisted only of non-EV owners, which may have led to a non-representative effect on the community at large. Being an EV owner is likely to be a very different experience from that of a non-EV owner, so the challenges each face in using their cars may inform alternate perspectives. Future research could have EV owners in the sample to understand more the challenges of implementing them and what can be done to reduce these challenges.

Third, this sample of Malaysians may tilt the results since different states have different barriers to electric vehicle adoption. For example, states with big urban areas, like Selangor or Kuala Lumpur, would have a more developed EV infrastructure, such as charging stations, than rural states like Kelantan or Perlis, where there may not even be such facilities. This disparity could potentially create differences in adoption rates. Furthermore, splitting the population into different income-level groups may reveal significant insights. EV adoption will likely be less of a financial strain for high-income consumers and much more of one for low-income ones. The sampling method will allow future studies to focus on specific barriers and facilitators of EV adoption tailored for each region.

Lastly, this study is restricted in its focus to variables on infrastructure, financial, technological, and environmental. This highlights the gaps in research regarding additional predictive elements impacting electric car (EV) adoption. The researcher believes that future research should consider other influencing factors in the uptake of electric cars (EVs), such as the role of government, cultural attitudes, social impact, and brand perceptions.

5.5 Conclusion

In conclusion, the results showed that the independent variables, namely infrastructure, financial, technological, and environmental perspectives, all influence one another in the uptake of electric cars in Malaysia. This study contributed to closing the gaps of knowledge in the electric car adoption studies in Malaysia.

Additionally, the environmental factor is shown to be the major barrier to the uptake of electric cars. The results indicated that Malaysians are prepared to act in the interest of the environment, as they are open to EVs to reduce carbon emissions and fight climate change. In addition, infrastructure problems, including insufficient public charging stations and dependable maintenance and repair services, needed to be addressed.

Financial factors like EV affordability, resale value, and battery repair prices would also influence the transition to EVs. At the same time, resistance to adoption was due to technological concerns from consumers about EVs, including the longevity of batteries, how long they took to charge, and the performance of the vehicle itself. Consequently, policymakers and industry stakeholders received invaluable insights. Policymakers can invest in public infrastructure, offer subsidies, and promote environmental education campaigns that teach society regarding the positive benefits of EV adoption.

Finally, this study focused on the joint effort that the government, business, and society have put to tackle the barriers to applying the electric vehicle (EV) in order to promote the transition to the EV. Potential environmental benefits of the accelerated adoption of EVs, include the reduction of global emissions of carbon and change of climate.

REFERENCES

Ajao, Q. and Sadeeq, L. (2023b) 'An Approximate Feasibility Assessment of Electric Vehicles adoption in Nigeria: Forecast 2030,' *arXiv (Cornell University)* [Preprint]. https://doi.org/10.48550/arxiv.2305.17844.

Alotaibi, S., Omer, S. and Su, Y. (2022b) 'Identification of potential barriers to electric vehicle adoption in Oil-Producing Nations—The case of Saudi Arabia,' *Electricity*, 3(3), pp. 365–395. https://doi.org/10.3390/electricity3030020.

Anastasiadou, K. and Gavanas, N. (2022) 'State-of-the-Art review of the key factors affecting electric vehicle adoption by consumers,' *Energies*, 15(24), p. 9409. https://doi.org/10.3390/en15249409.

Asadi, S. *et al.* (2021) 'Drivers and barriers of electric vehicle usage in Malaysia: A DEMATEL approach,' *Resources Conservation and Recycling*, 177, p. 105965. https://doi.org/10.1016/j.resconrec.2021.105965.

Asadi, S. *et al.* (2020) 'Factors impacting consumers' intention toward adoption of electric vehicles in Malaysia,' *Journal of Cleaner Production*, 282, p. 124474. https://doi.org/10.1016/j.jclepro.2020.124474.

Aungkulanon, P., Atthirawong, W. and Luangpaiboon, P. (2023) 'Fuzzy analytical hierarchy process for strategic decision making in electric vehicle adoption,' *Sustainability*, 15(8), p. 7003. https://doi.org/10.3390/su15087003.

Austmann, L.M. and Vigne, S.A. (2021) 'Does environmental awareness fuel the electric vehicle market? A Twitter keyword analysis,' *Energy Economics*, 101, p. 105337. https://doi.org/10.1016/j.eneco.2021.105337.

Babashahi, S., Hansen, P. and Peeters, R. (2022) 'External validity of multi-criteria preference data obtained from non-random sampling: measuring cohesiveness within and between groups,' *Annals of Operations Research*, 325(2), pp. 939–949. https://doi.org/10.1007/s10479-022-05026-2.

Babu, N. and Kohli, P. (2023) 'Commentary: Reliability in research,' *Indian Journal of Ophthalmology*, 71(2), pp. 400–401. https://doi.org/10.4103/ijo.ijo_2016_22.

Briefing, A. (2022) *Electric vehicles in Malaysia: tax incentives for owners and manufacturers*. https://www.aseanbriefing.com/news/electric-vehicles-in-malaysia-tax-incentives-for-owners-and-manufacturers/.

Bryła, P., Chatterjee, S. and Ciabiada-Bryła, B. (2022) 'Consumer Adoption of Electric Vehicles: A Systematic Literature Review,' *Energies*, 16(1), p. 205. https://doi.org/10.3390/en16010205.

Budget 2023: Extension of EV tax exemptions, more incentives - MIDA | Malaysian Investment Development Authority (2023). https://www.mida.gov.my/mida-news/budget-2023-extension-of-ev-tax-exemptions-more-incentives/#:~:text=The%20government%20has%20extended%20a,previously%20until%20Dec%2031%2C%202025.

Chan, M. (2024) *Malaysia EV sales: 13,257 units in 2023, 16,763 total, with 2,020 chargers; 20,000 EV sales expected in 2024*. https://paultan.org/2024/02/28/malaysia-ev-sales-13257-units-in-2023-16763-total-with-2020-chargers-20000-ev-sales-expected-in-2024/.

Chu, K.-M. (2023) 'A consumer innovation resistance theory perspective on the advanced driver assistance systems,' *Economic Research-Ekonomska Istraživanja*, 36(3). https://doi.org/10.1080/1331677x.2022.2153716.

Dinesh, S. and Mitra, S. (2023) 'Consumers' adoption of Electric Vehicles for Sustainability: Exploring the role of personality traits,' *Foresight-Russia*, 17(2), pp. 69–80. https://doi.org/10.17323/2500-2597.2023.2.69.80.

Fu, Z. (2023) 'Research on Quantitative Investment Strategy based on multifactor and double average model,' *Frontiers in Business Economics and Management*, 9(1), pp. 61–65. https://doi.org/10.54097/fbem.v9i1.8291.

Gupta, P., Jhamtani, H. and Bigham, J. (2022) 'Target-Guided dialogue response generation using commonsense and data augmentation,' *Findings of the Association for Computational Linguistics: NAACL 2022*, pp. 1301–1317. https://doi.org/10.18653/v1/2022.findings-naacl.97.

Hakulinen, U. *et al.* (2021) 'Reliability of the freehand Region-of-Interest method in quantitative cerebral diffusion tensor imaging,' *Research Square (Research Square)* [Preprint]. https://doi.org/10.21203/rs.3.rs-140421/v1.

He, S., Luo, S. and Sun, K.K. (2022) 'Factors affecting electric vehicle adoption intention: The impact of objective, perceived, and prospective charger accessibility,' *Journal of Transport and Land Use*, 15(1), pp. 779–801. https://doi.org/10.5198/jtlu.2022.2113.

Pv, I. and K, V. (2020b) 'Research designs-an overview,' *Kerala Journal of Psychiatry*, 32(1). https://doi.org/10.30834/kjp.32.1.2019.179.

Javed, F. *et al.* (2022) 'A Systematic Review of Barriers in adoption of Environmental Management Accounting in Chinese SMEs for Sustainable performance,' *Frontiers in Public Health*, 10. https://doi.org/10.3389/fpubh.2022.832711.

Jung, F., Schröder, M. and Timme, M. (2023) 'Exponential adoption of battery electric cars,' *PLoS ONE*, 18(12), p. e0295692. https://doi.org/10.1371/journal.pone.0295692.

Kongklaew, C. *et al.* (2021) 'Barriers to electric vehicle adoption in Thailand,' *Sustainability*, 13(22), p. 12839. https://doi.org/10.3390/su132212839.

Kuo, T.-C. *et al.* (2022) 'Toward Net-Zero: The Barrier Analysis of Electric Vehicle Adoption and Transition using ANP and DEMATEL,' *Processes*, 10(11), p. 2334. https://doi.org/10.3390/pr10112334.

Kwan, S.C. *et al.* (2022) 'Health impacts from TRAPs and carbon emissions in the projected electric vehicle growth and energy generation mix scenarios in Malaysia,' *Environmental Research*, 216, p. 114524. https://doi.org/10.1016/j.envres.2022.114524.

Lim, A. (2023) *Malaysia's EV roadmap – 10,000 CBU full electric cars tax free, 7,000 AC/500 DC charging points in LCMB*. https://paultan.org/2021/04/19/malaysias-ev-roadmap-proposes-7000-ac-and-500-dc-charging-points-10000-units-of-cbu-full-evs-tax-free/.

Lounis, M. (2020) 'A descriptive study of the current situation of COVID-19 in Algeria,' *Electronic Journal of General Medicine*, 17(6), p. em253. https://doi.org/10.29333/ejgm/8287.

Low Carbon Mobility Blueprint (LCMB) – Malaysian Green Technology and Climate Change Corporation (no date). https://www.mgtc.gov.my/what-we-do/low-carbon-mobility-2/low-carbon-mobility-blueprint/.

Malaysian Automotive Association (no date). http://www.maa.org.my/statistics.html.

Mamat, A. (2021) 'Malaysia has 32.3 million motor vehicles, 15.8 million drivers,' *NST Online*, 5 January. https://www.nst.com.my/news/nation/2021/01/654712/malaysia-has-323-million-motor-vehicles-158-million-drivers.

Mohapatra, S. (2020) 'Sampling in Research Series 1: Basic Concepts in Estimating sample size,' *Journal of Advanced Research in Medical Science & Technology*, 07(01), pp. 17–21. https://doi.org/10.24321/2394.6539.202003.

Murugan, M. and Marisamynathan, S. (2022) 'Analysis of barriers to adopt electric vehicles in India using fuzzy DEMATEL and Relative importance Index approaches,' *Case Studies on Transport Policy*, 10(2), pp. 795–810. https://doi.org/10.1016/j.cstp.2022.02.007.

Mustafa, S. *et al.* (2024) 'Role of environmental awareness & self-identification expressiveness in electric-vehicle adoption,' *Transportation* [Preprint]. https://doi.org/10.1007/s11116-024-10515-3.

Muzir, N.A.Q. *et al.* (2022) 'Challenges of electric vehicles and their prospects in Malaysia: A Comprehensive review,' *Sustainability*, 14(14), p. 8320. https://doi.org/10.3390/su14148320.

Pamidimukkala, A. *et al.* (2023) 'Barriers to electric vehicle adoption: A structural equation modeling analysis,' *Transportation Research Procedia*, 73, pp. 305–312. https://doi.org/10.1016/j.trpro.2023.11.922.

Pamidimukkala, A. *et al.* (2023b) 'Evaluation of barriers to electric vehicle adoption: A study of technological, environmental, financial, and infrastructure factors,' *Transportation Research Interdisciplinary Perspectives*, 22, p. 100962. https://doi.org/10.1016/j.trip.2023.100962.

Pang, J., Ye, J. and Zhang, X. (2023) 'Factors influencing users' willingness to use new energy vehicles,' *PLoS ONE*, 18(5), p. e0285815. https://doi.org/10.1371/journal.pone.0285815.

Roy, H. *et al.* (2022) 'Global Advancements and Current Challenges of Electric Vehicle Batteries and Their Prospects: A Comprehensive review,' *Sustainability*, 14(24), p. 16684. https://doi.org/10.3390/su142416684.

Schröder, M., Iwasaki, F. and Kobayashi, H., 2021. Current Situation of Electric Vehicles in ASEAN. *Promotion of Electromobility in ASEAN: States, Carmakers, and International Production Networks. ERIA Research Project Report FY2021*, *3*, pp.1-32.

Selvanathan, M. *et al.* (2020) 'EMPLOYEE PRODUCTIVITY IN MALAYSIAN PRIVATE HIGHER EDUCATIONAL INSTITUTIONS,' *PalArch's Journal of Archaeology of Egypt / Egyptology*, 17(3), pp. 66–79. https://doi.org/10.48080/jae.v17i3.50.

Singh, F.A. *et al.* (2023) 'Assessing the performance of QSP models: biology as the driver for validation,' *Journal of Pharmacokinetics and Pharmacodynamics*, 51(5), pp. 533–542. https://doi.org/10.1007/s10928-023-09871-x.

Sun, Y. *et al.* (2023) 'Multiple Regression: methodology and applications,' *Highlights in Science Engineering and Technology*, 49, pp. 542–548. https://doi.org/10.54097/hset.v49i.8611.

Sürücü, L. and Maslakçi, A. (2020) 'VALIDITY AND RELIABILITY IN QUANTITATIVE RESEARCH,' *Business and Management Studies an International Journal*, 8(3), pp. 2694–2726. https://doi.org/10.15295/bmij.v8i3.1540.

Tan, D. (2024) *EV sales in Malaysia – 10,159 units sold in 2023, up 286% vs 2022; hybrid sales also increased by 40%*. https://paultan.org/2024/01/16/ev-sales-in-malaysia-10159-units-sold-in-2023-up-286-vs-2022-hybrid-sales-also-increased-by-40/.

Tiu, J., Ramharack, S. and Hosein, P. (2023) 'On the Optimal Placement of Electric Vehicle Charging Stations,' *arXiv (Cornell University)* [Preprint]. https://doi.org/10.48550/arxiv.2306.11069.

Tsai, J.-F. *et al.* (2024) 'Electric vehicle adoption barriers in Thailand,' *Sustainability*, 16(4), p. 1642. https://doi.org/10.3390/su16041642.

Virmani, N. *et al.* (2023) 'Mitigating barriers to adopting electric vehicles in an emerging economy context,' *Journal of Cleaner Production*, 414, p. 137557. https://doi.org/10.1016/j.jclepro.2023.137557.

Wong, S.D. *et al.* (2023) 'Do incentives make a difference? Understanding smart charging program adoption for electric vehicles,' *Transportation Research Part C Emerging Technologies*, 151, p. 104123. https://doi.org/10.1016/j.trc.2023.104123.

Xia, Z., Wu, D. and Zhang, L. (2022) 'Economic, functional, and social factors influencing electric vehicles' adoption: An empirical study based on the diffusion of Innovation Theory,' *Sustainability*, 14(10), p. 6283. https://doi.org/10.3390/su14106283.

Xue, Y. *et al.* (2024) 'Understanding the Barriers to consumer purchasing of Electric Vehicles: The Innovation Resistance Theory,' *Sustainability*, 16(6), p. 2420. https://doi.org/10.3390/su16062420.

APPENDIX 1

GANTT CHART FOR PSM I

No.	Task/ Weeks	March			April				May					June			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Briefing PSM 1								MID TERM BREAK								
2	Topic Selection																
3	Construct problem statement table																
4	Revise the problem statement table																
5	Construct chapter 1																
6	Revision and discussion with the supervisor																
7	Construct chapter 2																
8	Revision and discussion with the supervisor																
9	Construct chapter 3																
10	Revision and discussion with the supervisor																
11	Presentation for PSM 1																
12	Edit PSM Report																
13	Submission of report PSM 1																

APPENDIX 2

GANTT CHART FOR PSM II

No.	Task/ Weeks	Oct		Nov					Dec			Jan				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Briefing PSM 2								MIDTERM BREAK							
2	Revision and discussion with the supervisor															
3	Collecting data															
4	Analyze data															
5	Revision and discussion with the supervisor															
6	Construct chapter 4															
7	Construct chapter 5															
8	Submission report to supervisor															
9	Revision of the report															
10	Presentation for PSM 2															
11	Revision PSM report															
12	Submission of full PSM 2															

APPENDIX 3

SURVEY QUESTIONNAIRE

Enhancing the Acceptance of the Adoption of Electric Vehicles (EVs) in Malaysia

Dear Respondent,

Thank you for taking the time to participate in this survey. My name is Tong Kok Hui, and I am a final-year student researching to fulfill the requirements of my bachelor's degree Final Year Project at Fakulti Pengurusan Teknologi dan Teknousahawanan, Universiti Teknikal Malaysia Melaka.

This survey explores factors that can enhance the acceptance and adoption of electric vehicles (EVs) in Malaysia by identifying key barriers influencing potential users. Electric vehicles (EVs) operate using electric motors powered by stored electricity rather than traditional internal combustion engines. As a sustainable alternative, EVs help to reduce air pollution, promote cleaner air, and contribute to environmental preservation.

This survey is intended explicitly for non-EV owners who hold a valid driver's license, allowing us to gather insights from individuals who have not yet made the switch to electric vehicles. By understanding the perceptions and challenges faced by this group, we hope to provide recommendations to support greater EV adoption across Malaysia. Thank you for your contribution toward a more sustainable future.

Mempertingkatkan Penerimaan Penggunaan Kenderaan Elektrik (EV) di Malaysia

Responden Yang Dihormati,

Terima kasih kerana meluangkan masa untuk menyertai kaji selidik ini. Nama saya Tong Kok Hui, dan saya merupakan pelajar tahun akhir yang sedang menjalankan penyelidikan bagi memenuhi keperluan Projek Tahun Akhir Ijazah Sarjana Muda saya

di Fakulti Pengurusan Teknologi dan Teknousahawanan, Universiti Teknikal Malaysia Melaka.

Kaji selidik ini bertujuan untuk meneroka faktor-faktor yang boleh meningkatkan penerimaan dan penggunaan kenderaan elektrik (EV) di Malaysia dengan mengenal pasti halangan-halangan utama yang mempengaruhi bakal pengguna. Kenderaan elektrik (EV) beroperasi menggunakan motor elektrik yang dikuasakan oleh tenaga elektrik yang disimpan, berbanding dengan enjin pembakaran dalaman tradisional. Sebagai alternatif yang mampan, EV dapat membantu mengurangkan pencemaran udara, memperbaiki kualiti udara, dan menyumbang kepada pemeliharaan alam sekitar.

Kaji selidik ini disasarkan khusus kepada individu yang tidak memiliki kenderaan elektrik dan yang mempunyai lesen memandu yang sah, bagi membolehkan kami mengumpul pandangan daripada golongan yang masih belum beralih kepada penggunaan kenderaan elektrik. Melalui pemahaman mengenai persepsi dan cabaran yang dihadapi oleh kumpulan ini, kami berharap dapat mengemukakan cadangan bagi menyokong peningkatan penerimaan terhadap kenderaan elektrik di Malaysia. Terima kasih di atas sumbangan anda untuk mencapai masa depan yang lebih mampan.

Information/*Maklumat:*

1. Completion of this form will take you approximately 5-10 min/ *Pengisian borang ini akan mengambil masa lebih kurang 5-10 min.*

2. The contents of this questionnaire will be kept strictly confidential & for academic purpose only/ *Kandungan soal selidik ini akan dirahsiakan sepenuhnya & untuk tujuan akademik sahaja.*

Instruction/ *Arahan*

There are THREE (3) sections in this questionnaire. Answer All sections/ *Terdapat TIGA (3) bahagian dalam soal selidik ini. Jawab Semua bahagian.*

Inquiry/ *Pertanyaan:*

If you have any questions or concerns about answering this questionnaire, please do not hesitate to contact:

Jika anda mempunyai sebarang soalan atau kebimbangan tentang menjawab soal selidik ini, sila jangan teragak-agak untuk menghubungi.

Tong Kok Hui Student (B062110165) Faculty of Technology Management and Technopreneurship. Universiti Teknikal Malaysia Melaka Hang Tuah Jaya 76100 Durian Tunggal Melaka. Email: Contact:	Madam Adilah Binti Mohd Din Supervisor Faculty of Technology Management and Technopreneurship. Universiti Teknikal Malaysia Melaka Hang Tuah Jaya 76100 Durian Tunggal Melaka. Email:

Thank you for your time and effort

SECTION A: DEMOGRAPHICS/ *BAHAGIAN A: DEMOGRAFI*

This section relates to your background in brief. Please tick (/) for your answer.

Bahagian ini berkaitan dengan latar belakang anda secara ringkas. Sila tandakan (/) untuk jawapan anda.

1. Age range/ *Julat Umur:*

1	18 to 22 years/ *18 hingga 22 tahun*		5	38 to 42 years/ *38 hingga 42 tahun*	
2	23 to 27 years/ *23 hingga 27 tahun*		6	43 to 47 years/ *43 hingga 47 tahun*	
3	28 to 32 years/ *28 hingga 32 tahun*		7	48 to 52 years/ *48 hingga 52 tahun*	
4	33 to 37 years/ 33 hingga 37 tahun		8	53 years and above/ *53 tahun ke atas*	

2. Gender/ *Jantina:*

1	Male/ *Lelaki*		2	Female/ *Perempuan*	

3. Race/ *Bangsa:*

1	Malay/ *Melayu*		3	Indian/ *India*	
2	Chinese/ *Cina*		4	Other (please specify) / Lain-lain (sila nyatakan):	

4. State of origin/ *Negeri asal*

1	Johor	
2	Kedah	
3	Kelantan	
4	Kuala Lumpur	
5	Malacca	
6	Negeri Sembilan	
7	Pahang	
8	Penang	
9	Perak	
10	Perlis	
11	Sabah	
12	Sarawak	
13	Selangor	
14	Terengganu	

5. Education Level / *Tahap Pendidikan*

1	Primary School / *Sekolah Rendah*		4	Bachelor's Degree / *Ijazah Sarjana Muda*	
2	Secondary School / *Sekolah Menengah*		5	Master's Degree / *Ijazah Sarjana*	
3	Certificate/Diploma / *Sijil/Diploma*		6	Doctorate (PhD) / *Ijazah Kedoktoran*	

6. Occupation/ *Pekerjaan*

1	Private Sector Employee / *Pekerja Sektor Swasta*	
2	Government Employee / *Pekerja Sektor Kerajaan*	
3	Self-employed / *Bekerja Sendiri*	
4	Retired / *Pesara*	
5	Unemployed / *Tidak Bekerja*	

7. Monthly Household Income / *Pendapatan Isi Rumah Bulanan*

1	Less than RM1,500 / *Kurang daripada RM1,500*		4	RM4,500 - RM5,999	
2	RM1,500 - RM2,999		5	RM6,000 - RM7,499	
3	RM3,000 - RM4,499		6	More than RM7,500 / *Lebih daripada RM7,500*	

8. Do you currently own a vehicle? / *Adakah anda memiliki kenderaan?*

1	Yes/ *Ya*		2	No/ *Tidak*	

9. Do you have a valid driving license? / Adakah anda mempunyai lesen memandu yang sah?

1	Yes / *Ya*		2	No / *Tidak*	

10. Type of car/ *Jenis kenderaan*

1	Conventional Vehicle/ *Kenderaan Konvensional*		3	Battery Electric Vehicles/ *Kenderaan Elektrik Bateri*	
2	Hybrid Electric Vehicle/ *Kenderaan Elektrik Hibrid*				

11. Brand of car/ *Jenama kereta*

1	Audi		5	Nissan	
2	BMW		6	Perodua	
3	Honda		7	Proton	
4	Hyundai		8	Toyota	
5	Kia		10	Other (please specify)/ *Lain-lain (sila nyatakan):*	

12. How frequently do you use your vehicle? / *Seberapa kerap anda menggunakan kenderaan anda?*

1	Daily / *Harian*		3	Occasionally / *Sekali-sekala*	
2	Several times a week / *Beberapa kali seminggu*		4	Rarely / *Jarang*	

13. Are you familiar with electric vehicles (EVs)? / *Adakah anda biasa dengan kenderaan elektrik (EV)?*

1	Yes/ *Ya*		2	No/ *Tidak*	

14. Do you have any interest or plans to own an EV within the next 1-5 years? / *Adakah anda berminat atau merancang untuk memiliki EV dalam tempoh 1-5 tahun akan datang?*

1	Very Interested / *Sangat Berminat*		3	Not Interested / *Tidak Berminat*	
2	Interested / *Berminat*				

15. How aware are you of government policies or incentives for EV adoption in Malaysia? / *Sejauh mana anda sedar mengenai dasar atau insentif kerajaan untuk penggunaan EV di Malaysia?*

1	Very aware / *Sangat sedar*		3	Not aware / *Tidak sedar langsung*	
2	Somewhat aware / *Agak sedar*				

16. Which electric vehicle (EV) brands are you familiar with? (You may select more than one)/ *Jenama kenderaan elektrik (EV) manakah yang anda kenali? (Anda boleh memilih lebih daripada satu)*

1	Audi		5	Nissan	
2	BMW		6	Tesla	
3	Build Your Dream (BYD)		7	Kia	
4	Hyundai		8	Other (please specify)/ *Lain-lain (sila nyatakan):*	

SECTION B: FACTORS INFLUENCE THE ADOPTION OF ELECTRIC VEHICLES (EVS)/ *BAHAGIAN B: FAKTOR MEMPENGARUHI PENGGUNAAN KENDERAAN ELEKTRIK (EVS)*

The following statements relate to the four main factors influencing the adoption of electric vehicles (EVs). Please indicate how much you agree or disagree with each statement using the provided scale.

Pernyataan berikut berkaitan dengan empat faktor utama yang mempengaruhi penggunaan kenderaan elektrik (EV). Sila nyatakan sejauh mana anda bersetuju atau tidak bersetuju dengan setiap pernyataan menggunakan skala yang disediakan.

Scale/ *Skala:*

1	2	3	4	5
Strongly Disagree/ *Sangat tidak setuju*	Disagree/ *Tidak setuju*	Neutral/ *Neutral*	Agree/ *Setuju*	Strongly Agree/ *Sangat setuju*

A. Infrastructure/ *Infrastruktur*

		1	2	3	4	5
1	I am confident that the compatibility of charging stations with my vehicle will enhance my interest in purchasing an EV. *Saya yakin bahawa kesesuaian stesen pengecasan dengan kenderaan saya akan meningkatkan minat saya untuk membeli EV.*					
2	The wide availability of public charging stations motivates me to consider an EV. *Ketersediaan stesen pengecas awam yang luas mendorong saya untuk mempertimbangkan EV.*					
3	Having the option for home charging makes EV ownership more appealing to me. *Pilihan untuk pengecasan di rumah menjadikan pemilikan EV lebih menarik bagi saya.*					
4	Access to reliable maintenance and repair services is essential in owning an EV.					

	Akses kepada perkhidmatan penyelenggaraan dan pembaikan yang dipercayai adalah penting dalam memiliki EV.					
5	Fast charging speeds at public stations add to the appeal of purchasing an electric vehicle. *Kelajuan pengecasan yang pantas di stesen awam menambah daya tarikan untuk membeli kenderaan elektrik.*					

B. Financial/ *Kewangan*

		1	2	3	4	5
1	The affordability of an electric vehicle (EV) encourages me to consider it as a purchase option. *Kemampuan untuk memiliki kenderaan elektrik (EV) mendorong saya untuk mempertimbangkannya sebagai pilihan pembelian.*					
2	A substantial resale value for EVs increases my confidence in buying one. *Nilai jualan semula EV yang tinggi meningkatkan keyakinan saya untuk membelinya.*					
3	Knowing that battery replacement costs are manageable makes EVs more attractive. *Mengetahui bahawa kos penggantian bateri adalah terkawal menjadikan EV lebih menarik.*					
4	Long-term fuel savings add significant value to the overall investment in an electric vehicle (EV). *Penjimatan bahan api jangka panjang menambah nilai besar terhadap pelaburan dalam kenderaan elektrik (EV).*					
5	Understanding the maintenance costs associated with EVs helps me feel prepared for ownership. *Memahami kos penyelenggaraan yang berkaitan dengan EV membantu saya bersedia untuk pemilikan.*					

C. Technological/ *Teknologi*

		1	2	3	4	5
1	I appreciate the advancements in driving range, making EVs a more viable option for me. *Saya menghargai kemajuan dalam jarak pemanduan, menjadikan EV pilihan yang lebih praktikal bagi saya.*					
2	The durability and lifespan of EV batteries increase my ownership interest. *Ketahanan dan jangka hayat bateri EV meningkatkan minat saya untuk memilikinya.*					
3	Shorter charging times make EVs more convenient for daily use. *Tempoh pengecasan yang lebih pendek menjadikan EV lebih mudah untuk kegunaan harian.*					
4	The compatibility of charging stations across different brands increases my confidence in choosing an EV. *Keserasian stesen pengecasan merentas jenama yang berbeza meningkatkan keyakinan saya dalam memilih EV.*					
5	High performance efficiency in electric vehicles positively influences my decision to purchase one. *Kecekapan prestasi kenderaan elektrik secara positif mempengaruhi keputusan saya untuk membelinya.*					

D. Environmental/ *Alam sekitar*

		1	2	3	4	5
1	I am encouraged by the environmental benefits of responsible battery disposal. *Saya didorong oleh manfaat alam sekitar hasil daripada pelupusan bateri yang bertanggungjawab.*					
2	Eco-friendly battery production methods make EVs an appealing choice for me. Kaedah pengeluaran bateri yang mesra alam menjadikan EV pilihan yang menarik bagi saya.					

3	I believe that EVs contribute to reducing global warming and promote a healthier environment. *Saya percaya bahawa EV menyumbang kepada pengurangan pemanasan global dan mempromosikan persekitaran yang lebih sihat.*					
4	I am motivated to protect the environment in Malaysia and see EVs as part of that commitment. *Saya bersemangat untuk melindungi alam sekitar di Malaysia dan melihat EV sebagai sebahagian daripada komitmen itu.*					
5	Electric vehicles play an essential role in preserving the environment for future generations. *Kenderaan elektrik memainkan peranan penting dalam memelihara alam sekitar untuk generasi masa depan.*					

SECTION C: INTENTION TO ADOPT ELECTRIC VEHICLES (EVS)/ *BAHAGIAN C: NIAT MENGGUNAKAN KENDERAAN ELEKTRIK (EVS)*

The following statement relates to your intention to adopt the electric vehicle. Please indicate your agreement with the following statement concerning your intention to adopt electric vehicles (EVs).

Pernyataan berikut berkaitan dengan niat anda untuk menggunakan kenderaan elektrik. Sila nyatakan tahap persetujuan anda dengan kenyataan berkenaan hasrat anda untuk menggunakan kenderaan elektrik (EV).

Scale/ *Skala:*

1	2	3	4	5
Strongly Disagree/ *Sangat tidak setuju*	Disagree/ *Tidak setuju*	Neutral/ *Neutral*	Agree/ *Setuju*	Strongly Agree/ *Sangat setuju*

	Intention to adopt/ *Niat untuk menggunakan*	1	2	3	4	5
1	I am likely to purchase an electric vehicle if there are subsidies available for it.					

	Saya mungkin akan membeli kenderaan elektrik jika terdapat subsidi untuk pembeliannya.					
2	I am inclined to buy an electric vehicle when there is a sufficient number of public charging stations. *Saya cenderung untuk membeli kenderaan elektrik apabila terdapat jumlah stesen pengecas awam yang mencukupi.*					
3	Reduced charging times will increase my interest in purchasing an electric vehicle. *Masa pengecasan yang dikurangkan akan meningkatkan minat saya untuk membeli kenderaan elektrik.*					
4	I am motivated to purchase an electric vehicle because of its eco-friendly benefits. *Saya bermotivasi untuk membeli kenderaan elektrik kerana manfaatnya yang mesra alam.*					
5	I intend to transition to an electric vehicle as the driving range continues to improve. *Saya bercadang untuk beralih kepada kenderaan elektrik apabila jarak pemanduan semakin bertambah baik.*					