DO YOU WANT TO BUY AN ELECTRIC VEHICLE? EXAMINING THE CONSUMERS' PURCHASE MOTIVATION OF ELECTRIC VEHICLES.

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BY

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A final year project submitted in the partial fulfillment of the requirement for the degree of

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DECLARATION

I hereby declare that:

(1) This undergraduate FYP is the end result of my own work and that due acknowledgment has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this FYP has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) Sole contribution has been made by me in completing the FYP.

(4) The word count of this research report is 11405 words.

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DEDICATION

I would like to dedicate this research study to my beloved family members who have always supported me during the completion of this research project. I appreciate their continuous contributions, love and caring.

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TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATION

CO2	Carbon Dioxide
GHGs	Greenhouse gases
IEA	International Energy Agency
EVs	Electric Vehicles
BEVs	Battery Electric Vehicles
PHEV	Plug-in Hybrid Electric Vehicles
HEVs	Hybrid Electric Vehicles
FCEVs	Fuel Cell Electric Vehicles
ER-EVs	Extended-range Electric Vehicles
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
SN	Subjective Norm
PBC	Perceived Behavior Control
DV	Dependent Variable
IV	Independent Variable
SEM	Structural Equation Modeling
PLS-SEM	Partial Least Squares Structural Equation Modeling
CB-SEM	Covariance-based Structural Equation Modeling
CR	Composite Reliability
FLs	Factor Loadings
AVE	Average Variance Extracted
HTMT	Heterotrait-Monotrait
VIF	Variance Inflation Factor
ICEs	Internal combustion engines

PREFACE

In an era defined by environmental consciousness and technological innovation, the surge in Electric Vehicles (EVs) poses a pivotal question: "Do you want to buy an electric vehicle?" This research delves into the motivations propelling consumers toward EV adoption, exploring factors such as environmental concerns, economic considerations, technological advancements, and evolving infrastructure. The goal is to provide essential insights for policymakers, industry leaders, and the public, contributing to the ongoing discourse on sustainable mobility. Hence, this study will explore of consumer behavior as we decipher the motives steering the transition to electric vehicles.

ABSTRACT

This research explores the intricacies of the consumer's purchase intention for an EV in Malaysia, shedding light on the multifaceted factors that shape consumer attitudes and behaviors in response to the global push for sustainable transportation. Placed within the broader context of the evolving automotive landscape, this study employs Partial Least Squares Structural Equation Modeling (PLS-SEM) to comprehensively analyze the relationships between various latent variables derived from directly observed indicators. Notably, the investigation aims to unravel the complexities surrounding consumers' attitudes and behaviors toward EVs in Malaysia, considering the unique socio-cultural and economic factors at play. The findings reveal intriguing dynamics, indicating that while attitudes may not be strong predictors of behavior, perceived behavioral control, subjective norms, and environmental concern emerge as influential factors. Of particular significance is the robust correlation between positive behaviors related to EVs and the intention to purchase. These insights highlight the pivotal roles of individual empowerment, societal influences, and environmental consciousness in steering the trajectory of EV adoption. From a managerial standpoint, the research suggests tailoring interventions to capitalize on these influential factors, while at an industry level, it underscores the necessity for substantial incentives to overcome affordability and infrastructure barriers hindering widespread EV adoption in Malaysia. This study lays the groundwork for future investigations into emerging factors shaping EV adoption dynamics and contributes to the ongoing discourse on sustainable transportation in the region.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

The 25-year environment plan of the United Kingdom (HM Government, 2018) recently pointed out that the current magnitude of human impact on the planet is unparalleled. As stated in the Living Planet Report 2018 (WWF, 2018), there has been a 60% decline in the species of mammals, birds, fish, and reptiles since 1970. Policymakers and the general population face numerous challenges such as climate change, habitat loss, increased natural hazards, over-consumption, and non-circular resource use. Addressing these issues necessitates substantial individual actions, whether voluntary or mandated, to modify environmental behaviors. The British Social Attitudes Survey (Phillips et al., 2018) reveals that 95% of respondents believe climate change is likely, but they hold a moderate average score of 4.4 out of 10 regarding the efficacy of reducing their energy use in mitigating climate change. Carbon dioxide (CO2) represents a notable component within the category of greenhouse gases (GHGs), contributing significantly to the global warming phenomenon. Consequently, the challenge of reducing carbon emissions on a global scale is particularly pronounced, especially within the transportation sector, acknowledged as the most substantial contributor to emissions of CO2. According to a study published by the International Energy Agency (IEA) which states that the transport sector currently accounts for about 25% of the world's total greenhouse gas emissions; by 2030, that percentage is expected to rise to 50% (IEA, n.d.). Consequently, transitioning to more efficient vehicles is considered by various nations as an effective strategy to mitigate CO2 emissions.

Remarkably, the transport sector in Asian countries has notably influenced carbon emissions from transportation. As a result, international organizations have invested considerable attention and effort in diminishing consumer reliance on ICE (internal combustion engine) automobiles in order to lower the proportion of carbon dioxide released in transportation (Energy, 2017). In terms of global rankings for carbon

emissions, Malaysia stands in 24th position (CO2 Emissions by Country, 2020 - Knoema.com, n.d.), with the transportation industry representing 36.4% of energy utilization in the year 2020, making it the larger consumer (SURUHANJAYA, n.d.). Malaysia is a nation highly reliant on automobiles and exhibits one of the most substantial rates of car ownership in Southeast Asia. Conjecturally, a recent survey reveals that 85% of participants reported driving at least once every one to three days. The primary purposes for driving include commuting to and from work (74%), carrying out daily errands (65%), and engaging in weekend travel (36%) (Tan, 2022). Despite the high ownership of combustion engine vehicles among consumers, standing at approximately 89.7% in Malaysia (Anthony, 2019).

Meanwhile, a survey conducted by BMW Group indicates that eight out of 10 Malaysian drivers express a desire to see more electric vehicles (EVs) on the road (Tan, 2022). This statistic is quite significant in highlighting a positive attitude toward EV purchase. However, it is noteworthy that 59% of those surveyed still intend to purchase internal combustion engine (ICE) powered cars in the future. These findings underscore the notable dependence on cars in the daily routines of Malaysians, underscoring the country's pronounced car-centric culture. The escalating carbon emission ratio in Malaysia is anticipated to deteriorate unless there is an increased adoption of efficient and environmentally sustainable vehicles.

On the other hand, Electric vehicles (EVs) have emerged as a noteworthy technological advancement in recent years, captivating the interest of both researchers and regulators, primarily due to their association with sustainability in its broadest sense (Bhatti et al., 2021). Scholars consider EVs as efficient transportation solutions that contribute to conserving energy and mitigating the impact of GHGs (Cao et al., 2021). Although EVs are not solely digital innovations, the discourse surrounding digital twins in the EV domain emphasizes the creation of virtual replicas of physical models capable of exchanging information (Suhaib Kamran et al., 2022). The environmental benefits of smart EVs, including their clean, zero-emission nature and smooth ride experience, coupled with their smart features and potential for future digitalization, further contribute to positioning EVs

as digital innovations (Prock, 2022). Given the pressing concerns of global warming, pollution, and climate change worldwide (Sun & Kim, 2021), policymakers and stakeholders increasingly perceive EVs as transportation solutions that encourage the goals set forth in the Sustainable Development Goals (SDGs) of the United Nations, addressing social, economic, and environmental sustainability.

Therefore, encouraging consumers to switch to electric vehicles is crucial for mitigating transport GHG emissions. EVs play a vital role in the future of transportation as they play a significant role in diminishing emissions, improving air quality, and reducing noise associated with transport. Nevertheless, in developing countries, the widespread adoption of EVs has not effectively heightened consumer awareness.

1.1 Electric Vehicles

Electric vehicles (EVs) offer numerous advantages over conventional vehicles, such as energy conservation, reduced emissions, and decreased reliance on fossil fuels. However, the development of EVs has been hindered by challenges related to their power supply system, limiting their full potential (Wang et al., 2020). Overcoming these difficulties is crucial for addressing renewable energy sources and promoting ecological sustainability, with EVs playing a vital role (Yuan et al., 2020). Battery capacity is particularly important for EV performance and range, distinguishing it from other EV technologies (Zhang & Li, 2019).

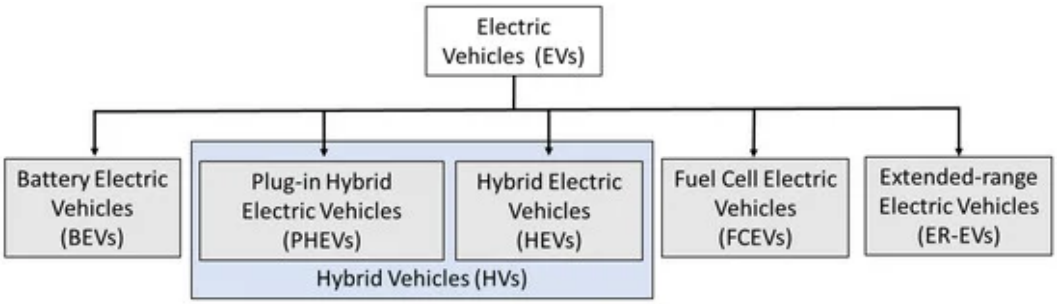
Although there have been significant advancements in batteries, issues like rapid capacity degradation due to traffic, road conditions, and driving styles remain a major concern for EVs (Zhang & Li, 2019). In the transportation industry, reducing combustion efficiency and pollutants is a significant and challenging task, given environmental and resource shortage concerns. Traditional battery-based energy

storage systems have limitations, including poor energy density and the need for frequent current changes, resulting in increased heat output and reduced battery life (Kai et al., 2018). To promote the wider purchase of EVs, improvements are needed in terms of precise energy management, specific performance, longer battery lifespan, and enhanced recharging efficiency (Wen et al., 2020).

1.1.1 Classification of Electric Vehicles

In the present day, there are several varieties of EVs available, distinguished by their engine technologies. Broadly speaking, these vehicles can be categorized into five types, as depicted in **Figure 1.1**.

Figure 1.1. Classification of EVSs based on their engine technologies and configurations



Adapted from: *Sanguesa et al. (2021)*

- BEVs operate solely on electric power, eliminating the need for internal combustion engines or liquid fuels. They utilize large battery packs to provide a range of approximately 160 to 250 km, with some models capable of reaching up to 500 km on a single charge. An exemplar of a BEV is the Nissan Leaf, a fully electric vehicle equipped with a 62 kWh battery, enabling drivers to cover up to 360 km without recharging (Kane, 2019).

- PHEVs combine both traditional combustion engines and electric engines that can be charged using an external electric source. These vehicles can store electricity from the grid, resulting in reduced fuel consumption during regular driving conditions. The Mitsubishi Outlander PHEV, for instance, is equipped with a 12 kWh battery that enables drivers to travel approximately 50 km using only the electric engine (Mitsubishi Motors, n.d.). However, it is important to note that PHEVs tend to have higher fuel consumption than car manufacturers typically indicate (Plötz et al., 2020).
- HEVs also feature a combination of conventional and electric engines, but they cannot be charged using an external source. The battery that powers the electric engine in HEVs is charged by the vehicle's combustion engine or through regenerative braking. The fourth-generation Toyota Prius hybrid, for example, includes a 1.3 kWh battery that theoretically allows for an electric range of up to 25 km (Sanguesa et al., 2021).
- FCEVs employ an electric engine that utilizes compressed hydrogen and oxygen, resulting in water as the only byproduct. While FCEVs are often referred to as "zero emissions," it is important to remember that natural gas accounts for a sizable amount of the hydrogen utilised, though green hydrogen is also an option (Sanguesa et, 2021). The Hyundai Nexo, which has a range of up to 650 kilometres before requiring refuelling, is an illustration of an FCEV.
- ER-EVs closely resemble BEVs but feature an additional combustion engine that is exclusively used for charging the vehicle's batteries when necessary. Unlike PHEVs and HEVs, the supplementary engine in ER-EVs is not connected to the vehicle's wheels (Kane, 2018). With a 42.2 kWh battery that offers an electric range of 260 km and an additional 130 km in extended-range mode, the BMW i3 is an example of an ER-EV.

1.2 Problem Statement

EVs are recognized as promising alternatives to conventional vehicles due to their ability to reduce reliance on fossil fuels and decrease air pollution. Despite the mentioned benefits of EVs, their full realization has been hindered by the lack of user purchase (Li et al., 2017). Currently, EVs hold a small market share in the transportation sector. For example, the transportation sector in Malaysia heavily relies on fossil fuels, accounting for 97% of the country's carbon monoxide emissions, 52% of nitrogen oxide emissions, and 18% of particulate matter emissions (Asadi et al., 2021). Although the Malaysian government's initial plan in 2005 to reduce carbon emissions by nearly 40% by 2020, the latest report from the World Bank indicates that Malaysia's carbon dioxide production in 2020 exceeded the levels observed in 2005. As a result, there is significant pressure on the Malaysian transportation sector to decrease fossil fuel consumption and mitigate GHGs. In response, the Malaysian government has taken steps to promote the purchase of electric vehicles (EVs) by implementing various policies. However, compared to other countries such as China, the rate of EV purchase in Malaysia remains relatively slower despite the increasing trend. (Asadi et al., 2022). Hence, the outcomes of this research can offer policymakers in Malaysia valuable insights to shape and implement programs or projects that enhance consumer awareness, incentivize EV purchases, and prioritize key factors that contribute to building a sustainable transportation system (Afroz et al., 2015). The theory of planned behaviour is regarded as an appropriate theoretical framework for this research because consumer actions have a significant impact on involvement, consumption, and acceptance.

1.3 Research Questions

The information mentioned above has motivated the need to study the take-up of EVs among Malaysians and the factors that influence consumers to purchase EVs. Generally, this study aim to understand the consumer’s perception towards EV and their intention to purchase one. Below is the specific research question:

(1) Will consumers' attutides influence the behavior of an EV?
(2) Will consumers' subjective norms influence the behavior of an EV?
(3) Will consumers' perceived behavioral control influence the behavior of an EV?
(4) Will consumers' environmental concerns influence the behavior of an EV?
(5) What is the relationship between the behavior of an EV and the intention to purchase an EV?

1.4 Research Objectives

The primary objectives of this study include: (1) Identifying the primary factors that influence consumers' attitudes, subjective norms, and perceived behavioral control in relation to the acquisition of EVs within the Malaysian context; (2) Assessing the influence of attitudes, subjective norms, and perceived behavioral control on consumers' intentions to procure EVs in Malaysia; (3) Investigating the direct impact of environmental concern on consumers' attitudes, subjective norms, perceived behavioral control, and intentions to purchase EVs in Malaysia.

1.5 Significance of the Study

The primary objectives of this study include: (1) Identifying the primary factors that influence consumers' attitudes, subjective norms (SN), and perceived behavioral control (PBC) in relation to the acquisition of EVs within the Malaysian context; (2) Assessing the influence of attitudes, SN, and PBC on consumers' intentions to procure EVs in Malaysia; (3) Investigating the direct impact of environmental concern on consumers' attitudes, SN, PBC, and intentions to purchase EVs in Malaysia.

1.6 Outlines of the Thesis

This thesis follows a structured approach to examine the variables affecting consumers' EV purchase intentions, which is presented in five chapters.

Chapter 1 is the Introduction. The introduction provides the background and context of the study, along with the problem statement and research objectives. Chapter 2 present a review of the existing research and theories related to the purchase of EV, leading to the development of hypotheses. The methodology section is showcased in Chapter 3. Hence, Chapter 3 outlines the research design, data collection procedure, and analysis techniques used. Chapter 4 is the Results section, in which it presents and interprets the findings, followed by a discussion that summarizes the results, compares them with the literature, and discusses their implications. Finally, the last chapter provides a summary of the research, discusses the limitation, and may have some practical recommendations.

1.7 Summary

The study explores the factors influencing consumers' purchase intention of EVs in the context of Malaysia. It begins by highlighting the urgent need to address environmental challenges and reduce carbon emissions in the transportation sector. The classification of electric vehicles and their advantages over conventional vehicles are discussed, emphasizing their potential to contribute to energy conservation and mitigate greenhouse gas emissions. The research question is posed, focusing on the low purchase rate of EVs in Malaysia despite government initiatives. The objectives of the study are outlined, including identifying key factors influencing consumers' attitudes and intentions toward EV. The significance of the study is emphasized, highlighting its implications for policymakers, marketers, and

the environment. The thesis structure is presented, outlining the subsequent chapters' content, which includes the literature review, research methodology, data analysis, discussion of findings, and conclusion with practical recommendations and limitations.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

This section mainly looks at and addresses existing literature or empirical studies on the research variables in order to outline the current research's objective. The aim of this research tends to expand on previous findings and enhance comprehension of the subject matter being examined. By synthesizing and critically evaluating previous studies, the literature review chapter sets the context for the research, establishes the theoretical framework, and guides the formulation of research objectives and research questions.

2.1 The Global Development of Electric Vehicles

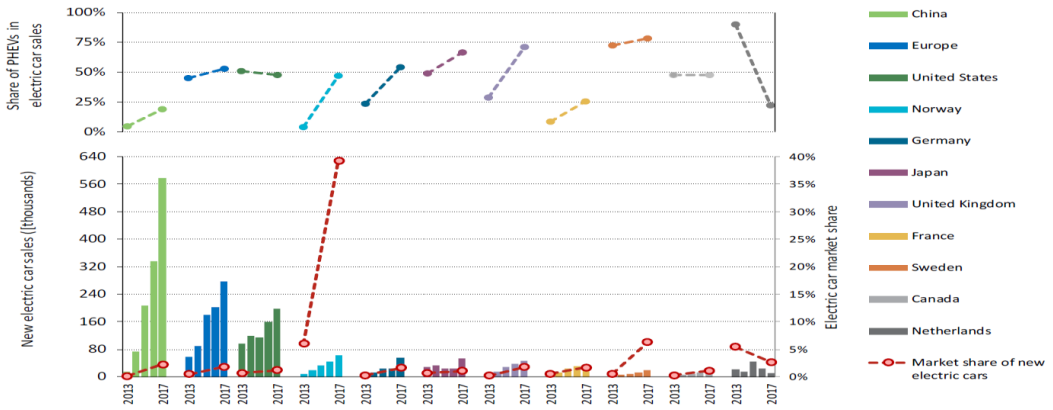
Approximately 3.29 million BEVs were sold in 2018, up 41% from the previous year, according to IEA statistics. Over 3 million EVs were in use worldwide in 2018, a rise of 46% from the previous year (International Energy Agency, 2019). Aiming to attain a 30% market share for EVs in every country that is part of the Electric Vehicles Initiative (EVI) by 2030, the "EV30@30" campaign was launched in 2017 during the Eighth Clean Energy Ministerial (EV30@30 Campaign | Clean Energy Ministerial, n.d.). This campaign focuses on enhancing global electric vehicle ownership, developing battery production technology and materials, establishing charging infrastructure, promoting energy and fuel efficiency, mitigating the impact of GHGs, and implementing other sustainability measures.

In reaction to these developments, a number of governments have established targets pertaining to electric cars, giving stakeholders and automakers more clarity

and restoring their faith in upcoming legislative frameworks. A number of nations, including Norway by 2025, Ireland, the Netherlands, and Slovenia by 2030, Scotland by 2032, the United Kingdom, Sri Lanka, and France by 2040, have even declared their intention to outlaw automobiles with internal combustion engines. These announcements represent important turning points for the electric car sector. On the other hand, a number of nations have established goals for the overall amount or percentage of EVs by specific time frames (Ninela, 2019). For example, Spain aims to reach 2.5 million EVs by 2020, Germany and India target 1 million, Portugal aims for 750,000, and South Korea aims for 200,000 EVs. Looking ahead to 2030, Finland aims for 250,000 EVs, Malaysia targets 100,000 electric cars, and South Africa aims for a 20% share of electric cars. Norway is regarded as a pioneering nation in the field of e-mobility because of the effective implementation of financial incentives. The IEA has noted a notable increase in the worldwide inventory of electric vehicles, which it attributes to the development of charging infrastructure and the decrease in battery prices. China became the global leader in the EV market in 2017 with about 580,000 EVs sold. Norway is the clear market leader for electric vehicle market share, according to the IEA. The top ten EV-producing nations in terms of market share and sales are shown in **Figure 2.1**.

Figure 2.1 Top 10 Leading EV Countries in terms of Sales and Market Share

Source



Adapted from: *IEA (2018)*

Given the rapid growth of the electric vehicle industry, researchers worldwide have increasingly focused on understanding consumers' behavior and purchase intention. It has been noted that consumers are becoming more inclined to purchase electric vehicles. The majority of the research has been conducted at the national or regional levels, thus the results are conflicting and inconclusive. Thus, it would be interesting to investigate the fundamental reasons why consumers with a range of traits and values buy EVs. It would be beneficial for legislators, automakers, and marketing firms to have a better understanding of the diverse range of adopters and the values they associate with EVs. EV sales are still difficult to increase in many countries.

Furthermore, by examining existing studies on purchase EV and incorporating an individual perspective, a deeper understanding of the diffusion process can be achieved. This approach facilitates the identification of unique patterns within the decision-making process of purchasing EVs. Investigating how consumers assess various EV features and how their individual characteristics affect how they view this innovation is crucial. Thus, the study aims to investigate the variables that influence Malaysian people's decisions to purchase EV and how these variables may differ from earlier findings.

2.2 Theory of Planned Behavior (TPB)

TPB represents a development of (Ajzen,1991) Theory of Reasoned Action (TRA). The main theoretical contribution of TPB to TRA is the inclusion of perceived behavioural control, which refers to the perceived ease or difficulty of performing a behavior. While TRA focuses solely on individuals' intentional processes, which include attitude towards behavior and subjective norm, TPB incorporates both intentional and non-volitional processes. By considering a wider range of factors, TPB provides a more comprehensive explanation of individuals' intentions (Botetzagias et al., 2015).

Ajzen and Fishbein (2000) posit that an individual's attitude towards a particular behaviour is indicative of their inclination, whether positive or negative, to consistently respond to that activity. Subjective norms are a reflection of the social pressure that is thought to be imposed by the opinions and shared beliefs of significant referents regarding a given action. Individuals' perceptions of how easy or difficult it is to carry out a particular behavior are related to their perceived behavioural control (Botetzagias et al., 2015).

TPB has earned considerable acclaim in the social psychology community and is extensively used to forecast people's actions in a variety of domains, such as healthcare, driving after alcohol consumption, environmental behaviour, and pro-environmental behaviour. Additionally, it can improve on the conventional framework to explain the variables influencing consumers' self-interest more fully, which is essential for pro-environmental behavior (Poortinga et al., 2004). Thus, in this study, TPB is used to investigate Malaysian consumers' purchase intentions for environmentally friendly EVs. (Inkpen & Baily, 2019).

2.3 Attitude

According to TPB, attitude is one of the three independent determinants of behavioral intention. The degree to which a person views a particular behaviour favourably or unfavourably is referred to as their attitude (Ajzen, 1991). An individual's salient beliefs, which include behavioural beliefs about the behavior's perceived consequences and outcome evaluations about the significance of those consequences, are the foundation upon which their attitude is formed (Eagly & Chaiken, 1993). Positive evaluation of the outcomes associated with a behavior leads to a favorable attitude, which increases one's willingness to participate in that behavior (Ajzen, 1991).

Attitude encompasses three key elements: cognitive, affective, and behavioral. The cognitive aspect relates to an individual's beliefs, thoughts, and characteristics associated with an object or issue. When considering EVs, the cognitive component of attitude may involve beliefs about the environmental impact of EVs. Research conducted by Wang et al. (2017) in China on hybrid electric vehicle (HEV) consumers found that environmental concerns indirectly influenced customer's behavior and positively correlated with attitudes towards HEVs. Furthermore, interpersonal influence and community expectations influence consumers' attitudes regarding adopting vehicles with new technologies. Emotional aspects including identity, self-perception, and a desire to help the environment can also have a big influence on how people form their attitudes about EVs (Khurana et al., 2019)

2.4 Subjective Norm

Subjective norm is another determinant of behavioral intention in TPB. It represents the perceived social pressure to perform or not perform a behavior (Ajzen, 1991). Subjective norm is influenced by an individual's normative beliefs, which reflect the perception of what significant others think one should or should not do, and the motivation to comply with those referents (Ajzen & Fishbein, 1980). Significant others can include relatives, close friends, co-workers, or business partners who influence decision-making. Subjective norm plays a significant role in shaping behavioral intention and has been extensively studied in marketing and consumer behavior contexts (Hee, 2000). Hence, subjective norms can be defined as consumers' beliefs about whether significant others believe they should or should not purchase an electric vehicle (Asadi et al., 2021; Huang & Ge, 2019).

2.5 Perceived Behavioral Control

Perceived Behavioral Control (PBC) is the third determinant of behavioral intention in TPB. It refers to the perceived ease or difficulty of performing a behavior (Ajzen, 1991). It involves assessing one's control beliefs, which pertain to the perception of available resources and opportunities required to perform the behavior, as well as the evaluation of the importance of those resources for achieving desired outcomes (perceived power) (Chang, 1998). Individuals' self-confidence in their ability to perform a behavior positively influences their intention and behavior. If an individual perceives limited control due to a lack of necessary resources, their intention to engage in the behavior may be lower, even if they have a positive attitude and subjective norm towards it. In the area under study, PBC is the term used to describe how consumers perceive the degree of ease or difficulty involved in their intention to buy an electric vehicle (Huang & Ge, 2019). Research has indicated that consumers' intentions to buy are stronger when the PBC for a green product is greater. (Sreen et al., 2018; Xu, Hua, Wang, & Xu, 2020).

2.6 Environmental Concern

One important concept that remains connected to environmental thoughts or worldviews on both a personal and a global level is environmental concern. (Inkpen & Baily, 2019). It is considered an essential personal belief and plays a role in shaping consumers' decision-making regarding pro-environmental behaviors. Previous studies have shown that individuals who are environmentally concerned are more likely to select eco-friendly options and engage in pro-environmental behaviors (Afroz et al., 2015; Lai et al., 2015). The purchase of EVs, for instance, often expresses a motivation to protect the environment and reduce carbon emissions, which provides them with a sense of honor and intrinsic emotional reward (Hartmann et al., 2017).

Growing worldwide environmental concerns, spurred by significant environmental problems and calls for environmental protection from the government, are

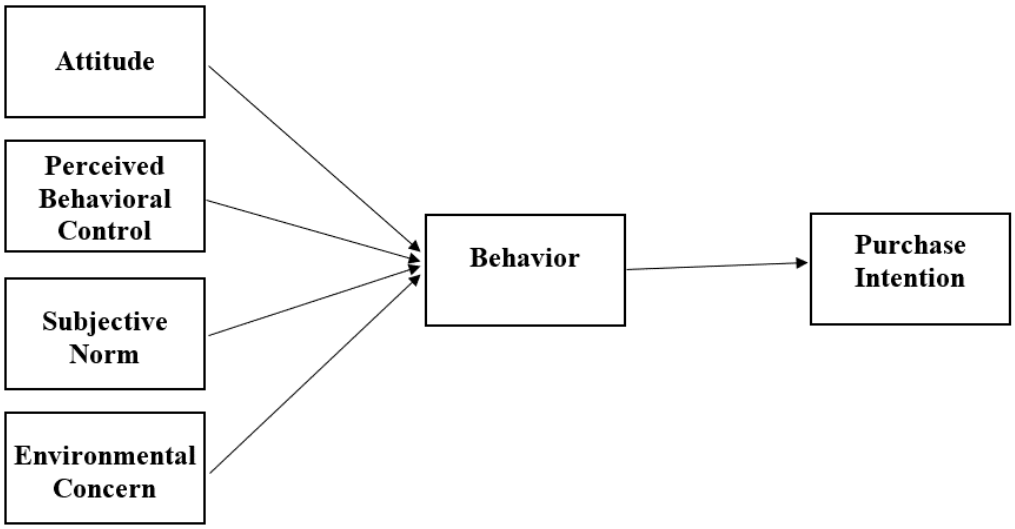
responsible for the increased interest in EVs. EVs are thought of as environmentally friendly innovations that can lessen environmental problems like air pollution caused by the transportation sector. Individuals who place a high value on environmental preservation are more inclined to take action to safeguard the environment (Akroush et al., 2019). In the context of Malaysia, where air pollution is a concern, the purchase of EV can be seen as a means to improve air quality and contribute to environmental protection (Lai et al., 2015).

In conclusion, TPB provides a comprehensive framework for understanding consumers' intentions to purchase EVs. Attitude, subjective norm, and perceived behavioral control are the key determinants of behavioral intention, while environmental concern plays an important role in shaping individuals' motivation to purchase pro-environmental EVs. By examining these factors, policymakers and marketers can gain insights into consumers' behavior and develop strategies to encourage the purchase of EV.

2.7 Research Framework

Based on the above discussion, the conceptual framework is presented in **Figure 2.2.**

Figure 2.2: Conceptual framework



Source: Developed for the research

2.8 Hypothesis Development

Below are the hypotheses developed following from the above discussion and conceptual framework:

Hypothesis 1 (H1)

Attitude is positively related to the behavior of an EV.

Hypothesis 2 (H2)

Perceived behavioral control is positively related to the behavior of an EV.

Hypothesis 3 (H3)

Subjective norm is positively related to the behavior of an EV.

Hypothesis 4 (H4)

Environmental concern is positively related to the behavior of an EV.

Hypothesis 5 (H5)

Behavior is positively related to the purchase intention of EV.

2.9 Summary

This chapter presents a comprehensive literature review that delves into the global development of electric vehicles (EVs) and the increasing environmental concerns driving the interest in purchasing EV. Moreover, in this chapter also successfully develops a research framework based on the Theory of Planned Behavior (TPB) and formulates hypotheses to examine the relationships between key factors and purchase intentions. The literature review and framework provide a solid foundation for the subsequent chapters, paving the way for the research methodology and analysis of findings.

CHAPTER 3: RESEARCH METHODOLOGY

3.0 Introduction

The methodical approach and procedures used to carry out research, collect data, evaluate information, and make conclusions are referred to as research methodology. It provides a structured framework for the entire research process, ensuring that data is collected and analyzed rigorously and reliably (Goundar, 2012). This chapter will provide an overview of the selected research design, sampling design, data collection techniques, and suggested data analysis tools that collectively comprise the research methodology for this investigation. To ensure that the research findings are legitimate and credible, a clear methodology is essential.

3.1 Research Design

In general, there are a wide variety of research design types. The goals of the study influence the research design that is selected. With a focus on Malaysia, the current study attempts to explore the variables affect consumers' decisions to buy EVs. A thorough picture of consumers' attitudes, SN, PBC, environmental concerns, and customer behaviour towards the purchase intention of an EV can be obtained through the methodical collection and analysis of data made possible by the descriptive research design.

The descriptive research design is focused on observing and collecting data without attempting to establish cause-and-effect relationships. Its primary objective is to provide a detailed and comprehensive understanding of a particular population or phenomenon. Descriptive research methods involve the collection of both

qualitative and quantitative data through surveys, observations, or case studies. The data collected is then analyzed to identify patterns, relationships, and trends within the dataset. The findings from descriptive research contribute to the existing knowledge on the topic and can guide future research and decision-making processes (Sirisilla, 2023). However, it is important to note that descriptive research does not aim to explain or predict outcomes but rather to provide a descriptive account of the subject being studied.

Apart from descriptive, explanatory research design is also adopted in this study (George & Merkus, 2021). the explanatory research design aims to test the impact of attitudes, subjective norms, perceived behavioral control, and environmental concern on understanding the consumers' behavior. It seeks to determine whether these factors play a significant role in explaining consumers' intentions to buy EVs and whether these intentions ultimately translate into actual buying behavior. By examining the relationships between these variables, the study aims to provide a deeper understanding of the drivers behind consumers' decision-making processes of EV.

3.1.1 Quantitative Research

The systematic and standardised approach to data collection offered by quantitative research ensures consistency and dependability in the measurement of variables. This is important for obtaining accurate and comparable data from a large sample of participants. Secondly, quantitative research allows for statistical analysis, enabling the identification of patterns, relationships, and trends within the data. This analytical approach facilitates the exploration of variables affecting consumers' intention to buy EVs in Malaysia, providing valuable insights for policymakers and marketers. Additionally, quantitative research is more objective as it is based on numerical data. Thus, quantitative research is proposed for this research as questionnaire surveys will be used to collect data.

3.2 Sampling Design

The process of choosing a portion of people or items from a larger population to take part in a research study is referred to as the sampling design. A carefully thought-out sampling strategy guarantees that the chosen sample is representative of the intended audience and permits the findings to be broadly applied. The target population will be clearly defined, a sampling frame will be established, and appropriate sampling techniques will be employed.

3.2.1 Target Population

A target population is a particular set of people for whom the researcher intends to make inferences or apply the results more widely. The larger population that the research sample is drawn from is represented by it. (Barnsbee, 2018). The target population in this research refers to Malaysian consumers who are potential buyers of electric vehicles and express an intention to purchase them.

Therefore, in order to recruit participants, visits were made to various car dealerships in Malaysia, where potential customers interested in purchasing electric vehicles were identified. The car dealerships provided a convenient setting for accessing individuals who were actively consider purchasing EV. During the visits to the car dealerships, potential participants were approached and informed about the research study. They were asked whether they would be interested in participating by completing a questionnaire survey regarding their attitudes and intentions towards the purchase of EV. The convenience of approaching individuals in a setting where they were actively exploring EV options ensured a sample of individuals with a genuine interest in the topic.

3.2.2 Sampling Technique

A sampling technique refers to the method or procedure used to select individuals or units from the target population to form a sample for research purposes (Nikolopoulou, 2022). The research objectives, population characteristics, available resources, and feasibility all play a role in selecting a sampling technique.

Purposive sampling methodology is employed in this study as the survey respondents are specifically collected from car dealerships or car showrooms. By doing this, there can be a more direct collection of opinions and perspectives from individuals who are actively considering purchasing a car. Purposive sampling is the deliberate selection of subjects who fit particular requirements or exhibit particular traits that support the goals of the study. By specifically targeting this group of potential car buyers, the study aims to capture insights that are relevant to their decision-making process and factors influencing their behavior and purchasing intention of EV.

3.2.3 Sampling Frame

The sampling frame refers to the list or source from which the potential participants or sampling units are drawn. It provides the basis for selecting individuals to be included in the sample for the research study (Villegas, 2022). The sampling frame used in this study is a combination of offline and online platforms. Participants were recruited from various locations, including car dealerships or automotive showrooms in the target geographical area. In addition, the survey was also extended to online platforms such as social media groups and online car groups or

car forums on the internet. For instance, Autoworld.com.my, Wapcar.com, Paultan.org., CarBase.my, Zigwheels.my, etc.

By utilizing the sampling frame of car dealerships or automotive showrooms, potential participants who are more likely to show interest in electric vehicles can be approached in a systematic manner. Besides that, these online platforms serve as virtual communities where individuals with an interest in cars gather to discuss and share information about various automotive topics, including electric vehicles. Including online car groups in the sampling frame expands the study's reach to a wider audience and enables the collection of diverse perspectives. The Internet provides an extensive and accessible platform for individuals who may not visit physical car dealerships but actively participate in online discussions regarding cars, including electric vehicles. This multi-channel approach promotes inclusivity and enhances the sample's diversity, facilitating a comprehensive understanding of the factors influencing consumers' decisions to purchase an EV.

3.2.4 Sample Size

Currently, the majority of researchers use a table to calculate the sample size that Krejcie and Morgan (1970) suggested. A statistical formula that takes into account the population size, population proportion, degree of accuracy expressed in proportion, and table value of chi-square for one degree of freedom at the desired confidence level was used to create the sample size table (Krejcie & Morgan, 1970). The table was then simplified by illustrating the relationship between sample size and total population. It is vital to note that the sample size for a population of more than 1000000 remains at 384, with a margin error of 5% and a confidence level of 95% (Krejcie & Morgan, 1970).

Following Krejcie and Morgan (1970), a sample size of 384 is recommended for a population size of 17,486,589 registered car owners who are potential EV car buyers (CEIC DATA, 2021). In this study, out of the 400 questionnaires distributed, 207 complete survey responses were received, resulting in a response rate of approximately 51.75%, highlighting a substantial engagement from the target audience. The decision to select this sample size was driven by the need to strike a balance between capturing adequate data to represent the target population and avoiding the drawbacks of excessively small or large sample sizes. A small sample size can lead to ambiguous findings and ethical concerns, while an overly large sample size can be resource-intensive and potentially risky for participants. By opting for 200 complete survey questionnaires, the research aims to obtain statistically valid results and accurate estimates of population parameters while remaining manageable and cost-effective. This sample size provides a reasonable level of confidence in the representativeness of the data and the generalizability of the findings to the larger population (Fleetwood, 2018).

3.3 Data Collection Method

The systematic gathering of information to address research questions and hypotheses is a component of data collection methods. Both primary and secondary data collection techniques will be used in this study.

3.3.1 Primary Data

Original information that is directly gathered by the researcher with the express intent of solving the research problem is referred to as primary data. It is firsthand data that is obtained through the researcher's own efforts and experience (Formplus Blog, 2020).

In this study, primary data will be collected through questionnaire surveys administered to the target population of Malaysian consumers interested in electric vehicles. Thus, a total of 400 questionnaires was sent out using the Google Form method. Additionally, data collection efforts were extended to car dealerships and showrooms, providing an opportunity to directly engage with individuals who are actively considering purchasing a car. Google Forms was chosen as the survey tool due to its convenience and accessibility, allowing respondents to easily access and complete the questionnaire at their own convenience. By utilizing the Google Form method, respondents can conveniently access and complete the questionnaire at their own pace and convenience. This approach allows for the collection of specific and customized information directly from the participants, providing valuable insights into their attitudes, preferences, and intentions regarding the behavior to purchase an electric vehicle.

3.3.2 Secondary Data

Conversely, secondary data is information that has previously been gathered and documented by another party for a different reason unrelated to the subject of the current study. The data is easily accessible and can be found in a variety of places, including books, online databases, government publications, internal records, reports, censuses, and journals (Formplus Blog, 2020a). In this study, secondary data will be collected from various sources, including industry reports, academic journals, government publications, and online databases like UTAR Library and Google Scholar. These resources are a goldmine of knowledge about the variables influencing consumers' propensity to buy electric cars, industry developments, and pertinent statistical information. The inclusion of secondary data enhances the breadth and depth of the research findings, providing a broader context for interpreting the primary data and enriching the overall analysis.

To summarise, the research objective was to gather primary and secondary data in order to comprehend the factors that impact consumers' intention to buy electric vehicles in Malaysia. The primary data will offer specific insights from the target population, while the secondary data will provide broader industry and market perspectives. This combination of data sources will enable a more robust analysis and interpretation of the research findings.

3.4 Measurement Scales

Measurement scales play a crucial role in research by providing a structure for defining and categorizing variables. The four primary categories of measurement scales, namely nominal, ordinal, interval, and ratio, guide researchers in analyzing data appropriately. These scales possess distinct properties, including identity, magnitude, equal intervals, and a minimum value of zero, which determine the suitable methods for data analysis (UNSW SYDNEY, 2020). In this study, data is collected from the survey questionnaire using nominal and ordinal scales. This allows for the classification and ranking of responses based on specific categories or levels.

3.4.1 Nominal Scale

Nominal scales are used to categorize data into distinct groups or categories. In this scale, the data are assigned labels or names to represent different categories or attributes. However, there is no inherent order or hierarchy among these categories, and they cannot be quantitatively measured or compared in terms of magnitude or intervals. (UNSW SYDNEY, 2020) The categorization of respondents based on specific characteristics enables the grouping of individuals according to these attributes, facilitating further analysis of the research findings.

By examining the demographic information, patterns and relationships between various demographic variables and the factors affecting consumers' propensity to buy EV can be identified. This categorization allows for an exploration of how demographic factors, including gender, age, income, and education level, might impact individuals' attitudes, intentions, and behaviors related to the purchase of electric vehicles.

Furthermore, categorizing the respondents based on demographic information helps in segmenting the data and identifying any variations or trends within specific demographic groups. This segmentation can contribute to a more nuanced analysis and interpretation of the research findings, providing deeper insights into the factors affecting consumers' intention to buy EVs among different demographic segments.

3.4.2 Ordinal Scale

Ordinal scales of measurement involve the arrangement and ranking of data into categories or levels based on their relative order or position (UNSW SYDNEY, 2020). The questionnaire develop comprises Section B employs an ordinal scale of measurement. Using a scale from 1 (strongly disagree) to 7 (strongly agree), respondents can indicate how much they agree or disagree with each statement. The data collected using this scale can be ranked and ordered based on the respondents' opinions, but it does not provide information about the precise magnitude or distance between the response options.

For example, in the Attitude section, respondents are asked to rate their agreement with statements related to the benefits of electric vehicles (EVs) and their personal satisfaction with owning an environmentally-friendly EV. The responses are categorized into levels such as "Strongly Disagree," "Disagree," "Somewhat

Disagree," "Neutral," "Somewhat Agree," "Agree," and "Strongly Agree." The ranking of responses allows for comparisons between different statements and helps identify the general attitudes and perceptions of respondents towards EVs. The use of the ordinal scale in this research enables the collection of data that reflects the relative agreement or disagreement of respondents with specific statements.

3.4.3 Measurement Instruments

The measurement items used in this study were adopted from previous studies. The variables and their corresponding measurement items were sourced from various research articles, as indicated in **Table 3.1**.

Table 3.1 Measurement Instruments

Variables	Measurement Items	Source
Attitude	1. I think electric vehicles would be beneficial to the environment in the long term. 2. Electric vehicles can decrease the use of petroleum. 3. I would feel satisfied about myself if I buy an environmental-friendly electric vehicle. 4. I like the idea to own an environmentally-friendly electric vehicle.	Afroz et al., 2015a; Barbarossa et al., 2015; Kaplan et al., 2016
Perceived behavioral control	1. The price of an electric vehicle is important to me and I can afford it when I decide to adopt it. 2. The maintenance and repair of an electric vehicle is important to me when I decide to adopt it.	Han, 2015; Wang et al., 2016; Eneizan 2019

	3. I can find where to buy an electric vehicle if I wanted to.	
Subjective norm	1. Most people who are important to me think I should adopt an electric vehicle when adopting a vehicle in the near future. 2. If I buy an electric vehicle, then most people who are important to me would also buy an electric vehicle. 3. Most people who are important to me would want that I use an environmentally-friendly electric vehicle instead of an internal combustion engine vehicle.	Wang et al., 2016; Han, 2015; Afroz et al., 2015a
Environmental concern	1. I am concerned about environmental problems. 2. I think people should change their behavior to reduce climate change and protect the environment. 3. I think climate change is a threat to me and my family. 4. I think environmental problems are becoming more and more serious in recent years.	Lai et al., 2015; Kim et al., 2018; Wang et al., 2016
Behavior	1. I want to purchase an EV. 2. I will choose to purchase an EV. 3. I like using EVs. 4. I want to continue using EVs if I have one. 5. I am interested in EVs. 6. I want to make a different to the environment by using EVs. 7. It is interesting to purchase EV.	Woong Suh, Seongjin Ahn

Purchase Intention	1. I intent to buy sustainable products because they are environment friendly. 2. I will help the environment by purchasing sustainable products and electric vehicle. 3. I would suggest others to buy and use sustainable products to save the environment. 4. I intend to purchase the electric vehicle although it is expensive. 5. I am very likely to purchase electric vehicles in the future.	Ajzen , Dodds

Source: Developed for the research

3.5 Method of Analysis

Statistics is a critical component of data analytics, playing a central role in identifying trends and patterns within large sets of numerical data. It is a branch of mathematics that allows for the interpretation and understanding of the available information. In this study, descriptive and inferential statistics will be used to analyze the data collected and derive meaningful insights.

To perform the statistical analysis, the data obtained from the questionnaire will be processed using the Partial Least Squares Structural Equation Modeling (PLS-SEM).

3.5.1 Descriptive Statistics

Descriptive statistics is a method used to understand and summarize the characteristics of a dataset. It provides a simple, meaningful way to describe, present, and summarize data. In this approach, researchers select a specific group

of interest, collect data from that group, and then analyze the data using summary statistics and graphical representations to describe the properties of the group (Simplilearn, 2023). Unlike inferential statistics, there is no uncertainty involved in descriptive statistics as it focuses on describing the actual individuals or items that were measured. The goal is not to make inferences about a larger population but rather to provide a clear and concise description of the data.

In this study, the presentation of the final results will incorporate the use of tables, charts, and graphs to enhance analysis and interpretation. The collected data and information from the questionnaire will be meticulously organized into well-structured tables, presenting relevant numerical data and summary statistics. This approach will provide a simpler and more intuitive means of understanding the research findings, which enables an easy grasp of the key insights and implications (Hillier, 2023).

3.5.2 Inferential Statistics

Inferential Statistics involves making predictions and drawing conclusions about a larger population based on a representative sample. Instead of examining the entire population, a random sample is selected to gather data and make inferences. This approach allows researchers to work with a smaller, manageable sample size. The predictions made through inferential statistics are probabilistic and provide estimates and probabilities rather than absolute facts. The accuracy of these predictions relies on the quality and representativeness of the sample data (Simplilearn, 2023). It is essential to obtain a random sample that accurately represents the population of interest. Results obtained from non-random samples are considered less reliable and may be disregarded.

Thus, random sampling is a crucial aspect of inferential techniques as it ensures the validity and generalizability of the conclusions. While implementing random sampling can be challenging, it plays a vital role in ensuring the reliability of the inferences drawn from the sample to the larger population (Hillier, 2023). In this study, inferential statistics will be utilised to formulate judgements and forecasts about the larger population of Malaysian consumers interested in electric vehicles based on the data collected from a representative sample. By extrapolating insights from the sample data, a more accurate understanding of the overall population can be obtained, leading to meaningful conclusions about the research questions under investigation.

3.5.3 Structural Equation Modeling (SEM)

SEM emerges as a potent statistical tool facilitating the examination of intricate interconnections among various variables within a solitary analysis. The SEM's measurement model delves into the associations between latent variables (constructs that remain unobservable) and their associated observable indicators (survey inquiries). This process enables the precise portrayal and quantification of the underlying constructs (Christ et al., 2017). The evaluation of the measurement model entails an appraisal of the measurement instruments' trustworthiness and dependability, which were employed to operationalize individual constructs. The structural model within SEM scrutinizes the relationships among latent variables while testing the posited causal routes between constructs. This model grants the capability to explore the direct and indirect impacts of variables on one another.

3.5.4 Partial Least Squares Structural Equation Modeling (PLS-SEM)

PLS-SEM has gained significant prominence in recent years as a statistical tool of choice. PLS-SEM employs a variance-based technique, offering flexibility in terms of sample size, the number of indicators, and data normality assumptions. This adaptability renders PLS-SEM highly conducive to theory development across diverse research contexts (Barroso et al., 2010). Furthermore, PLS-SEM accommodates the incorporation of formative indicators or dimensions within the model, addressing concerns related to the accurate definition and measurement of indicators. Notably, Coltman et al., (2008) emphasized that employing an incorrect measurement model can jeopardize the content validity of constructs, misrepresent the structural relationships among these constructs, and diminish the utility of management theories for business scholars and practitioners (Coltman et al., 2008).

In the realm of SEM, which is employed to dissect intricate associations between observed and latent variables, two prevalent methodologies exist: Covariance-based Structural Equation Modeling (CB-SEM) and PLS-SEM (Dash & Paul, 2021). While CB-SEM relies on covariance, also known as factor-based SEM, to approximate latent variables through common factors, PLS-SEM is rooted in variance, recognized as composite-based SEM (Sarstedt & Hwang, 2020).

For the present study, the adoption of PLS-SEM as the preferred statistical analysis approach can be rationalized by two fundamental considerations. Firstly, PLS-SEM empowers researchers to scrutinize intricate models (Sarstedt et al., 2020), aligning with the complexity of the current research model replete with numerous indicators, constructs, and structural paths. Secondly, PLS-SEM represents a causal predictive methodology that advances beyond regression-based techniques in the realm of social sciences by estimating path relationships with manifest variables (Sarstedt et al., 2017). Most recently, Sarstedt and Dank underscored that a model's explanatory power does not necessarily translate to robust predictive capabilities, even under identical or disparate contexts (Sarstedt & Danks, 2022). Given that the proposed research framework aims to provide cost-effective solutions for organizations navigating turbulent times, prioritizing predictability is paramount. These two

compelling attributes of PLS-SEM substantiate its appropriateness for this study's analytical approach.

3.6 Summary

The research methodology used in this study has been described in this chapter, offering a detailed and unambiguous framework for carrying out the investigation. Thorough consideration has gone into the selection of the research design, sampling strategy, techniques for gathering data, measurement scales, measurement tools, and analytic approach to guarantee the accuracy, consistency, and applicability of the study results. The next chapter will focus on data analysis, where the collected data will be analyzed and interpreted to derive meaningful insights and address the research objectives.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

In Chapter 4, the research undertakes a thorough data analysis, employing PLS-SEM to explore the relationships between latent variables derived from directly observed variables. The chapter meticulously evaluates the measurement model, ensuring convergent and discriminant validity.

4.1 Statistical Approach

PLS-SEM was used in the study for analysis for two primary reasons. First off, the study makes use of composite latent variables, which are derived from directly observed variables.

Henseler (2017) categorized constructs that are theoretically grounded but constructed specifically for research as artifacts composed of a mixture of elemental components, which he terms "design constructs." He recommends modeling these constructs using composites (Henseler, 2017). Scholars such as Rigdon et al. (2017) and Sarstedt et al. (2016) also advocate for using the PLS method when dealing with composite latent variables (Sarstedt et al., 2016); (Rigdon et al., 2017).

PLS-SEM stands out as an invaluable instrument for knowledge management researchers due to its capacity to process and evaluate data in terms of data requirements, model complexity, and relationship specifications efficiently and securely. Scholars have highlighted that PLS-SEM is especially fitting for estimating models with a focus on explanation and prediction (Ringle et al., 2023).

This implies a comprehensive grasp of the presumed relationships within the model and its capacity to forecast theoretical concepts under examination. Researchers who opt for PLS-SEM gain a substantial advantage in terms of statistical power when compared to CB-SEM (Reinartz et al., 2009; Hair et al., 2017). This advantage remains consistent even when estimating common factor model data, as assumed in CB-SEM (Sarstedt et al., 2016). The heightened statistical power of PLS-SEM enhances its ability to detect significant relationships when they exist within the population (Sarstedt & Mooi, 2014).

4.2 Measurement Model Evaluation

The study utilises a two-stage methodology for its analysis, starting with the measurement model evaluation and moving on to the structural model examination. According to Hair et al. (2011), the measurement model is known as the "outer model". This outer model measures each indicator's contribution to the associated construct and determines how well this set of indicators as a whole capture the concept as defined by Hair et al. (2014). The evaluation of the measurement model is based on reflective measures with a detailed investigation of internal consistency, convergent validity, and discriminant validity using Mode A measurement in PLS-SEM (Low et al., 2021).

Subsequently, the evaluation of the structural model includes the assessment of collinearity among exogenous constructs, the examination of the significance of path coefficients (β), the exploration of indirect effects, and the evaluation of the model's predictive accuracy, including out-of-sample predictive power and potential model comparisons if necessary (Low et al., 2021).

Evaluating a reflective measurement model involves considering convergent validity, internal consistency reliability, and discriminant validity. When assessing

the reflective factors, internal consistency is measured using Composite Reliability (CR), while Convergent Validity is evaluated through Factor Loadings (FLs) and Average Variance Extracted (AVE). CR values, ranging from 0 to 1, indicate the degree of reliability, with higher values denoting higher reliability. Nunnally and Bernstein (1994) state that in exploratory research, CR values greater than 0.6 are regarded as acceptable, and values between 0.7 and 0.9 are regarded as satisfactory. According to Hair et al. (2017), FLs should be at least 0.708 because an item's commonality is equal to the square of the outer loading of a standardised indicator. The construct's commonality is reflected in the AVE, which is deemed satisfactory when it is greater than 0.5 and indicates that the construct accounts for more than 50% of the variance in its items.

In the context of the present study, all factor loadings surpass the threshold value of 0.708, the values of Cronbach's alpha are above 0.7, the CR values are above 0.7, and AVE exceeds 0.5. The results of the complete dataset, presented in Table 4.1, confirm the achievement of convergent validity for the reflective measures.

Discriminant validity, as outlined by Hair et al. (2014), pertains to the degree to which each latent variable can be distinguished from other constructs within the model. It also encompasses the extent to which the indicators are distinct from those of other constructs (Hair et al., 2014). More recently, Hair et al. in 2019b have recommended that researchers employ the Heterotrait-Monotrait (HTMT) criterion for assessing discriminant validity. This recommendation aligns with the advice given by Henseler et al. (2015) and Rönkkö and Evermann (2013), who suggested using the HTMT ratio of correlation criterion for discriminant validity testing.

Henseler et al. (2015) further elaborated on establishing discriminant validity, emphasizing that HTMT statistics should not exceed 0.90 or 0.85, depending on the conceptual similarity of the constructs. As illustrated in Table 4.2, the majority of the HTMT values are below 0.90, in line with (Henseler et al., 2015) and (Gold et al., 2001). However, there is an issue with the construct of "purchase intention-

behavior of Electric vehicles," as it has a value of 0.917, indicating potential problems likely arising from overlapping items in respondents' perceptions of this particular construct.

Nonetheless, it's important to note that all the confidence interval values in Table 4.2 do not include the value 1, suggesting that all HTMT values are significantly different from 1, as highlighted by (Henseler et al., 2015). Consequently, it can be concluded that discriminant validity has been successfully established in the current study.

Table 4.1: Convergent validity for the variables

		(>0.708)	*(>0.7)*	*(>0.7)*	*(>0.7)*	*(>0.5)*
Constructs	**Items**	**Factor loadings**	**Cronbach's alpha**	**Composite reliability (rho_a)**	**Composite reliability (rho_c)**	**Average variance extracted (AVE)**
Attitude	A 1	0.875	0.914	0.925	0.939	0.795
	A 2	0.840				
	A 3	0.921				
	A 4	0.927				
Behaviour of Electric Vehicle	B EV 1	0.926	0.971	0.971	0.975	0.850
	B EV 2	0.932				
	B EV 3	0.931				
	B EV 4	0.911				
	B EV 5	0.932				
	B EV 6	0.911				
	B EV 7	0.908				
Environmental Concern	EC 1	0.884	0.903	0.912	0.932	0.774
	EC 2	0.903				
	EC 3	0.904				
	EC 4	0.826				
Perceived Behavioral Control	PBC 1	0.909	0.859	0.860	0.914	0.780
	PBC 2	0.901				
	PBC 3	0.838				
Purchase Intention	PI 1	0.879	0.942	0.943	0.956	0.813

	PI 2	0.935				
	PI 3	0.918				
	PI 4	0.863				
	PI 5	0.912				
Subjective Norm	SN 1	0.957	0.953	0.954	0.970	0.914
	SN 2	0.963				
	SN 3	0.948				

Source: Developed for the research.

Table 4.2: Discriminant validity assessment

Variable	Attitude	Behavior of Electric vehicle	Environmental Concern	Perceived Behavioral Control	Purchase Intention	Subjective Norm
Attitude						
Behavior of Electric Vehicle	0.749 [0.658;0.829]					
Environmental Concern	0.695 [0.582;0.786]	0.633 [0.521;0.734]				
Perceived Behavioral Control	0.816 [0.719;0.905]	0.774 [0.691;0.844]	0.682 [0.541;0.803]			
Purchase Intention	0.837 [0.755;0.904]	0.917 [0.874;0.955]	0.672 [0.557;0.773]	0.823 [0.730;0.894]		
Subjective Norm	0.753 [0.672;0.826]	0.790 [0.723;0.852]	0.546 [0.422;0.649]	0.668 [0.566;0.756]	0.866 [0.818;0.907]	

Source: Developed for the research.

4.3 Structural Model Evaluation

To assess the structural model, an analysis is conducted on the interconnections between constructs, focusing notably on path coefficients (β) and the coefficient of determination (R2). Moreover, this evaluation includes an examination of the Variance Inflation Factor (VIF) and effect size (f2), adhering to the criteria recommended by (Latan & Noonan, 2017). The complete results are presented in Table 4.3.

Prior to displaying the test results, VIF is used to assess the collinearity problem. A VIF value less than 3.3, according to Henseler (2017), suggests that collinearity does not obstruct the results' analysis. In Table 4.3, the VIF values are found to be below 3.3, leading to the conclusion that collinearity is not a concern in this research.

The assessment of the structural model proceeds with an examination of the coefficient of determination (R^2) and f^2. The R^2 signifies the model's predictive power, indicating the proportion of variance in the endogenous variables explained by all the exogenous variables. Hair et al. recommend that an R-squared value above 0.2 is acceptable in some fields, with values between 0.25 and 0.5 considered good for well-established fields (Hair et al., 2017). In this research, an R-squared of 0.693 indicates that 69.3% of the variability in behavior toward EVs is explained, while an R-squared of 0.77 indicates that 77% of the variability in purchase intention of EVs is accounted for.

The effect size of the constructs is assessed using Cohen's f^2 procedure (Cohen, 1988), which measures the relative impact of a predictor construct on an endogenous construct. According to Cohen (1988), values of 0.02, 0.15, and 0.35 are considered small, medium, and large, respectively. An overview of the results of the structural model assessment is presented in Table 4.3. The Behavior of Electric Vehicles stands out with the most substantial effect size (f^2=3.353), underscoring its pronounced impact on the model. Following closely is the Subjective Norm (f^2=0.300), indicating a moderate yet significant influence. In contrast, Attitude (f^2=0.013) and Environmental Concern (f^2=0.031) exhibit relatively smaller effect sizes, suggesting comparatively minor impacts within the structural model. Perceived Behavioral Control falls in between, with a moderate effect size of 0.112, signifying a discernible but not overpowering influence on the model.

Table 4.3: Structural model results

	R-square	R-square adjusted	f^2	VIF
Purchase Intention	0.770	0.769		
Behavior of Electric Vehicles	0.693	0.687	3.353	1.000
Attitude			0.013	3.012
Environmental Concern			0.031	1.804
Perceived Behavioral Control			0.112	2.325
Subjective Norm			0.300	2.118

Source: Developed for the research.

4.4 Hypotheses Testing

In order to test the hypothesis, coefficient parameters were looked at, and values obtained from each exogenous variables 95% bias-corrected confidence interval were considered significant. The results of the hypothesis testing for both the full sample and split samples are presented in Table 4.4.

For the full sample, H2, H3, H4, and H5 were supported and found to be significant at a p-value of 0.050, with a 95% confidence interval. In this research, only H1 was not supported, indicating no relationship between attitude and behavior toward EVs. A significant and positive relationship was observed between behavior toward EVs and purchase intention, with a beta (β) value of 0.025 and a p-value of 0.000, which is less than 0.005.

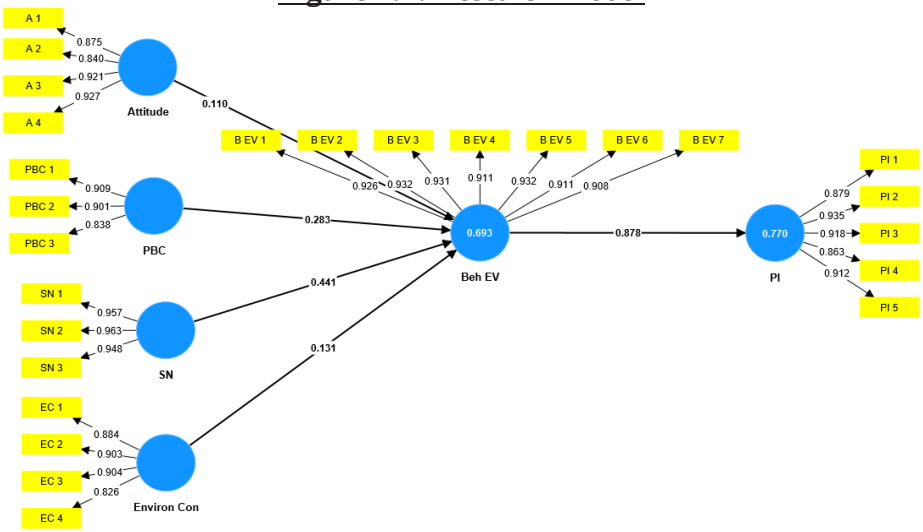
Additionally, a significant and positive relationship was identified between environmental concern and behavior toward EVs, with a beta (β) value of 0.072 and a p-value of 0.034, which is less than 0.005. Furthermore, a significant and positive relationship was observed between perceived behavioral control and behavior toward EVs, with a beta (β) value of 0.074 and a p-value of 0.000, which is less than 0.005. Finally, a significant and positive relationship was established between subjective norms and behavior toward EVs, with a beta (β) value of 0.073 and a p-value of 0.000, which is less than 0.005.

Table 4.4: Hypotheses testing results

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV) (β)	T statistics (|O/STDEV|)	P values	decision
H1: Attitude -> Beh EV[1]	0.110	0.118	0.091	1.210	0.113	NS
H2:Beh EV -> PI[2]	0.878	0.878	0.025	35.215	0.000	S
H3:Environ Con[3] -> Beh EV	0.131	0.134	0.072	1.828	0.034	S
H4:PBC[4] -> Beh EV	0.283	0.283	0.074	3.826	0.000	S
H5:SN[5] -> Beh EV	0.441	0.435	0.073	6.013	0.000	S

Source: Developed for the research.

Figure 4.1: Research Model



Source: Developed for the research

[1] **Beh EV → Behavior of Electric Vehicles**
[2] **PI→ Purchase Intention**
[3] **Environ Con → Environmental Concern**
[4] **PBC → Perceived Behavioral Control**
[5] **SN → Subjective Norm**

CHAPTER 5: DISCUSSION AND CONCLUSION

5.0 Introduction

This chapter serves as a synthesis of the key findings discussed in the preceding chapter. It delves into the implications of the research's outcomes, acknowledges its limitations, provides recommendations for future research, and concludes with a comprehensive summary.

5.1 Discussion on Findings

Building upon the data collected and analyzed in the preceding chapter, various assessments were undertaken to ensure the reliability of both independent and dependent variables. The reliability test revealed that all variables surpassed the 0.7 threshold, indicating a high level of reliability. **Table 5.1** presents the results of hypothesis testing, revealing key insights into the relationships between different variables and the behavior of EVs.

HI: There is a positive relationship between attitude and behavior of an EV.

Result: 0.113 ($p > 0.05$), Not supported.

Explanation: The research did not find sufficient evidence to support the hypothesis (H1) proposing a positive relationship between attitude and behavior of electric vehicles.

This outcome implies that the initial assumption of a direct positive association between attitude and behavior of electric vehicles, as posited by H1, is not substantiated by the study's findings.

H2: Perceived behavioral control is positively related to the behavior of an EV.

Result: 0.000 ($p < 0.05$), Supported.

Explanation: The research found strong evidence supporting H2, indicating a positive relationship between perceived behavioral control and the behavior of electric vehicles.

This suggests that individuals with a higher perceived control over their behavior are more likely to exhibit favorable actions towards EVs.

H3: Subjective norm is positively related to the behavior of an EV.

Result: 0.034 ($p < 0.05$), Supported.

Explanation: The study yielded evidence supporting H3, establishing a positive relationship between subjective norm and the behavior of electric vehicles.

This implies that social influences and norms play a role in shaping individuals' behavior regarding EVs.

H4: Environmental concern is positively related to the behavior of an EV.

Result: 0.000 ($p < 0.05$), Supported.

Explanation: The research provided compelling evidence supporting H4, indicating a positive association between environmental concern and the behavior of electric vehicles.

This underscores the influence of environmental consciousness on individuals' choices and actions related to EVs.

H5: Behavior is positively related to the purchase intention of EV.

Result: 0.000 ($p < 0.05$), Supported.

Explanation: The study uncovered a robust connection between behavior and purchase intention of electric vehicles, supporting H5. This suggests that individuals exhibiting positive behavior towards EVs are more likely to express an intention to purchase them.

In summary, the findings from the hypothesis testing reveal a nuanced landscape of factors influencing the behavior of electric vehicle adoption. While the initial hypothesis (H1) proposing a positive relationship between attitude and behavior was not supported, other factors such as perceived behavioral control, subjective norm, environmental concern, and the bidirectional relationship between behavior and purchase intention demonstrated significant associations in favor of electric vehicle adoption.

Table 5.1 Results of Hypothesis Testing

No.	Hypothesis	P-value score	Decision
H1	Attitude is positively related to the behavior of an EV.	0.113 ($p>0.050$)	Not supported
H2	Perceived behavioral control is positively related to the behavior of an EV.	0.000 ($p<0.050$)	Supported
H3	Subjective norm is positively related to the behavior of an EV.	0.034 ($p<0.050$)	Supported
H4	Environmental concern is positively related to the behavior of an EV.	0.000 ($p<0.050$)	Supported
H5	Behavior is positively related to the purchase intention of EV.	0.000 ($p<0.050$)	Supported

Source: Developed for the research.

5.2 Managerial Implication

The investigation into the relationship between consumers' attitudes and behaviors toward EVs yielded intriguing results. While no significant association was found between attitude and behavior, a pivotal discovery emerged in the positive relationship between behavior toward EVs and purchase intention. This suggests that engaging in behaviors related to EVs significantly influences individuals' intentions to purchase these vehicles. Furthermore, the exploration into the impact of subjective norms highlighted their crucial role in shaping consumer behavior. The study underlines the influence of social pressures and significant others on tangible behaviors associated with EVs, emphasizing the societal aspect in the adoption process. Perceived Behavioral Control emerged as a significant predictor of consumers' behavior concerning EVs. Those perceiving greater control over their ability to engage in EV-related behaviors exhibited a higher propensity to actualize these behaviors, emphasizing the importance of individual empowerment in the decision-making process. Environmental concern proved to be a potent factor, exerting a direct and substantial influence on consumers' attitudes, subjective norms, perceived behavioral control, and intentions to purchase EVs. This underscores the pivotal role of environmental consciousness in driving EV adoption in Malaysia. The robust connection established between consumers' behavior related to EVs and their intention to purchase signifies a positive trajectory for the EV market in Malaysia. As consumers actively engage in EV-centric behaviors, their inclination toward making a purchase is heightened, indicating a promising future for EV adoption.

5.3 Industry Implications

The recent news regarding Budget 2024 and its provisions for promoting electric vehicle (EV) adoption in Malaysia highlights the need for more substantial initiatives to drive the EV industry (The Star, 2023). While the budget introduces a

scheme to provide rebates for electric motorcycle ownership, it is met with mixed reviews from industry experts. The Malay Vehicle Importers and Traders Association of Malaysia's Vice-President, Raja Petra Marudin Raja Nordin, expressed concerns about the adequacy of these incentives. He pointed out that the cheapest EV motorcycle on the market is still significantly more expensive than conventional petrol motorcycles, making the transition less appealing, especially for those with limited income. Additionally, the four-year extension of tax exemptions for EV charging facilities is seen as a positive policy, but there is a need for clarity regarding how income tax deductions will be implemented (The Star, 2023).

In this context, experts in the Malaysian EV sector call for more robust incentives, particularly for the manufacturing sector, to attract foreign direct investment and enhance competition with neighboring countries. They stress the importance of making EVs more accessible and affordable to a broader range of consumers.

The Malaysian Electric Vehicles Owners Club President, Datuk Shahrol Azral Ibrahim Halmi, welcomed the extension of income tax exemptions for EV-charging expenses, highlighting the positive impact on EV infrastructure growth, skilled job creation, and service industries (The Star, 2023). He emphasized the role these incentives can play in narrowing the price gap between EVs and petrol-powered vehicles.

Universiti Teknologi PETRONAS (UTP)' Centre of Automotive Research and Electric Mobility researcher, Mohd Syaifuddin Mohd, noted the potential benefits of the RM2,400 rebate for electric motorcycle ownership. However, he also highlighted a critical obstacle to EV adoption—the lack of supercharging stations in Malaysia. He called for subsidies for supercharging stations in areas with lower EV demand, recognizing the need to address the chicken-and-egg problem where consumers hesitate to buy EVs without sufficient charging infrastructure (The Star, 2023).

The insights from these experts resonate with the challenges and opportunities in the electric vehicle industry, emphasizing the importance of crafting comprehensive policies that make EVs more appealing and accessible to a wider spectrum of consumers. The findings from this news highlight the significance of providing substantial incentives and addressing infrastructure challenges to promote the adoption of electric vehicles.

5.4 Limitations

While this study provides valuable insights into the purchase intention of EVs in Malaysia, certain limitations warrant consideration. The research primarily focuses on a specific geographic context may limit generalizability. Future research could enhance robustness by employing diverse methodologies and expanding the study's scope across regions or cultures. Moreover, exploring emerging factors such as government policies, technological advancements, and evolving consumer trends could contribute to a more nuanced understanding of EV adoption dynamics. Addressing these limitations would strengthen the research's applicability and contribute to a more comprehensive understanding of the evolving landscape of sustainable transportation.

To advance comprehension of EV adoption, subsequent research endeavors should explore cross-cultural variations and geographical diversity for broader applicability. Analyzing the influence of evolving government policies, technological advancements, and changing consumer trends on EV adoption dynamics holds the potential to provide profound insights. Methodologically addressing these aspects in future studies can contribute to a more comprehensive understanding of the evolving landscape of sustainable transportation, offering valuable insights for policymakers and industry stakeholders.

5.5 Conclusion

From a practical standpoint, this research offers implications for policymakers who need to introduce more attractive incentives for EV adoption in Malaysia. Currently, the Malaysian electric vehicle market is in its early stages and necessitates increased active participation from EV users to ensure the viability of a profitable EV market (Muzir et al., 2022). Such a market expansion would accommodate more EV manufacturers, dealers, and suppliers, fostering a competitive market structure that enhances EV service quality as well as matches with pricing. From a production standpoint, achieving a balance between reduced market prices and improved service quality requires a shift towards innovative features in various aspects, including charging infrastructure, charge control mechanisms, battery storage handling, and overall design (Muzir et al., 2022). Offering more significant advantages through EVs compared to internal combustion engines (ICEs) is a key motivator for ICE users to transition to EVs, aligning to reduce greenhouse gas emissions and promote environmental sustainability. In conclusion, this research forms the foundation for comprehending EV adoption in Malaysia and underscores the necessity for more compelling incentives, infrastructure development, and further exploration of the factors influencing this transformation in the automotive industry.

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APPENDICES

Do you want to buy an Electric Vehicle? Examining the consumers' purchase motivation of Electric Vehicles

Greetings to everyone. I am Yew Jun Sen, a Y2S3 student pursuing Bachelor's Degree of International Business (Hons) in Universiti Tunku Abdul Rahman (UTAR). I am currently conducting a research project with the topic of "**Do you want to buy an Electric Vehicle? Examining the consumers' purchase motivation of Electric Vehicles."**

You are invited to participate in this research by filling up this questionnaire.

This survey aims to examine the factors that motivate the consumers to purchase electric vehicles (EV). To help us have a better understanding about your view and opinion in relation to electric vehicles (EV). Please take a few minutes to complete and return this questionnaire.

Your cooperation and honest responses are highly appreciated for the success of my research. If you have any recommendations towards my survey, please do not hesitate to contact the researcher via email: junsenyew@1utar.my or via phone number 016-7133168.

The collected data serves academic purposes and will be aggregated with personal information being revealed.

Section A: Demographic Questions

Instruction: Please select and tick the box next to your accurate option or write in the space provided. Please tell us more about your personal information.

1. Gender

   □ Male

   □ Female

2. Age Group

□ 18-29

□ 30-39

□ 40-49

□ 50-59

□ 60 years and over

3. Race

□ Malay

□ Indian

□ Chinese

□ Others. Please specify _____

4. Marital status

□ Single

□ Married

5. Monthly income (MYR)

□ 5000 or below

□ 5001–10,000

□ 10,001–15,000

□ 15,001–20,000

□ 20,001–25,000

□ 25,001 above

6. Education level

□ secondary school (eg. SPM) and below

□ diploma/ advanced diploma

□ degree

□ postgraduate (eg. Master and above)

□ professional qualification

□ Others. Please specify _____

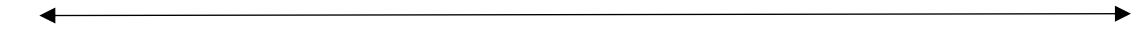
7. Number of private cars

□ 0

□ 1 □ 2 □ 3 or above
8. Choose and Rank THREE (3) primary reasons you own a car: _ Convenience for transportation and travel to work. _ Convenience for transportation and travel with family. _ Lack of viable alternatives to commute _ Enjoy driving or experience of car ownership _ Status or social reasons Others. Kindly specify _____

Section B: The followings are related to the external factors that will lead to the action to purchase the electric vehicle (EV). Kindly inform us your concern and opinion.

Please indicate how much you agree or disagree with each of the following statements based on a scale ranging from 1（strongly disagree) to 7 (strongly agree).



1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

1- **Strongly disagree (SD)**
2- **Disagree (D)**
3- **Somewhat disagree (SLD)**
4- **Neutral (N)**
5- **Somewhat agree (SLA)**
6- **Agree (A)**
7- **Strongly agree (SA)**

i	Attitude	SD	D	SLD	N	SLA	A	SA
1.	I think EV would be beneficial to the environment in the long term.	1	2	3	4	5	6	7
2.	EV can decrease the use of petroleum.	1	2	3	4	5	6	7
3.	I would feel satisfied about myself if I buy an environmental-friendly EV.	1	2	3	4	5	6	7
4.	I like the idea to own an environmentally-friendly EV.	1	2	3	4	5	6	7
ii	**Perceived behavioural control**	**SD**	**D**	**SLD**	**N**	**SLA**	**A**	**SA**
1.	The price of an EV is important to me and I can afford it when I decide to adopt it.	1	2	3	4	5	6	7
2.	The maintenance and repair of an EV is important to me when I decide to adopt it.	1	2	3	4	5	6	7
3.	I can find where to buy an EV if I wanted to.	1	2	3	4	5	6	7
iii	**Subjective norm**	**SD**	**D**	**SLD**	**N**	**SLA**	**A**	**SA**
1.	Most people who are important to me think I should adopt an EV when adopting a vehicle in the near future.	1	2	3	4	5	6	7
2.	If I buy an EV, then most people who are important to me would also buy an electric vehicle.	1	2	3	4	5	6	7
3.	Most people who are important to me would want that I use an environmentally-friendly EV	1	2	3	4	5	6	7

	instead of an internal combustion engine vehicle.							
v	**Purchase Intention**	**SD**	**D**	**SLD**	**N**	**SLA**	**A**	**SA**
1.	I intent to buy sustainable products because they are environment friendly.	1	2	3	4	5	6	7
2.	I will help the environment by purchasing sustainable products such as EV.	1	2	3	4	5	6	7
3.	I would suggest others to buy and use sustainable products to save the environment.	1	2	3	4	5	6	7
4.	I intend to purchase an EV although it is expensive.	1	2	3	4	5	6	7
5.	I am very likely to purchase EV in the future.	1	2	3	4	5	6	7
vi	**Behaviour**	**SD**	**D**	**SLD**	**N**	**SLA**	**A**	**SA**
1.	I want to purchase an EV.	1	2	3	4	5	6	7
2.	I will choose to purchase an EV.	1	2	3	4	5	6	7
3.	I like using EVs.	1	2	3	4	5	6	7
4.	I want to continue using EVs if I have one.	1	2	3	4	5	6	7
5.	I am interested in EVs.	1	2	3	4	5	6	7
6.	I want to make a difference to the environment by using EVs.	1	2	3	4	5	6	7
7.	It is interesting to purchase EV.	1	2	3	4	5	6	7

Section C: The followings is related to environmental concern on purchase electric vehicle (EV). Kindly inform us about your agreement.

Please indicate how much you agree or disagree with each of the following statements based on a scale ranging from 1（strongly disagree) to 5 (strongly agree)

1 2 3 4 5 6 7

Strongly Disagree — Neutral — Strongly Agree

iv	Environmental concern	SD	D	A/D	A	SA
1.	I am concerned about environmental problems.	1	2	3	4	5
2.	I think people should change their behaviour to reduce climate change and protect the environment.	1	2	3	4	5
3.	I think climate change is a threat to me and my family.	1	2	3	4	5
4.	I think environmental problems are becoming more and more serious in recent years.	1	2	3	4	5