Hybrid and Electric Vehicle Industry Challenge in the Malaysia Automotive Market in the Next 5 Years

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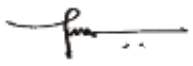
DECLARATION

The author hereby declares that this project paper is an original study conducted by him unless otherwise stated as acknowledgment has been given to the references cited in the bibliography. The views and analysis in this study are the views of the author based on the references made; and this is not an individual to use this study as a technical tool for investment.

Signature : 

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Abstract of the project paper submitted to the Senate of Universiti Tun Abdul Razak in partial fulfilment of the requirements for the Master in Management.

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By

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Currently, Hybrid and electric vehicles in Malaysia have developed well and are also attracting the attention of consumers. The sales performance of hybrid and electric vehicles in this country is still not encouraging, in addition, the awareness and level of knowledge about hybrid and electric vehicles is also still relatively low. In this survey, the challenges related to the development of hybrid and electric vehicles need to be thoroughly examined, it is necessary to think about what possibilities will be faced by the ministries and bodies in the government responsible for implementing the development of hybrid and electric vehicles. The vehicle industry as well as policy makers and both to players in the production industry as well as to consumers. In terms of cost expenditure also needs to be taken into account, the need for electric vehicle charging facilities. All obstacles and obstacles need to be identified so that they can be overcome which includes the opinions of electric vehicle users, travel needs, the state of Malaysia's economy, existing basic conditions that have been enacted by the Malaysian government and also the opinions and views of Malaysians regarding these hybrid and electric vehicles. Therefore a good proposal can be proposed to the Malaysian government to provide benefits and benefits to all users. It can be concluded to provide a good vision and mission for the future of the country and also to the people in general. The need for a coordinated study of all factors related to the latest technology, obstacles and ways to face, long-term solutions for the future development of the electric and hybrid vehicle industry in Malaysia. Detailed research and studies need to be done to produce positive results related to the hybrid and electric vehicle industry in Malaysia in the future. This can be implemented in line with Malaysia's National Automotive Plan 2020 and with the aim of increasing the number of energy efficient vehicles and green technology in the future.

CHAPTER 1

INTRODUCTION

Hybrid and electric vehicles have undergone significant evolutionary changes in recent times. Consumer awareness has increased towards these hybrid and electric vehicles. The increase in fuel prices has also caused many manufacturers to consider making changes from vehicles that use internal combustion engines to hybrid and electric systems as an alternative way of long-term solutions for consumers and directly also for players in the automotive industry so that they can compete for a long time. Development that positive has caused many car manufacturers to think about switching to hybrid and electric vehicles. Aggressive marketing done by manufacturers in recent times has attracted the interest of existing vehicle users to some extent. The consumer culture in Malaysia is that when there are many similar vehicles on the road, for example hybrid and hybrid vehicles of certain brands it will be more interesting to know more about the vehicle. Users prefer to get information directly from existing customers who have used this vehicle related to problems and other matters such as spare parts prices, after-sales service facilities, spare parts guarantees, ease of obtaining spare parts in the market, driving comfort, the main problems faced while using them and most importantly used car prices have dropped significantly or not.

1.1 Background of the Study

The effects of the COVID-19 disease epidemic that has hit the world have affected many industries that involve human life and socioeconomics, but even though the Covid pandemic has hit the world, the sales performance of hybrid and electric vehicles including the addition of infrastructure installation and facilities for charging and the rate of use of hybrid and electric vehicles is increasing worldwide. Today's world has changed where many representatives of vehicle manufacturers have recognized the change and transition to hybrid and electric vehicles that will increase economic growth and also the development of hybrid and electric vehicles around the world in addition to reducing the negative effects produced and indirectly taking care of the ecosystem and cleanliness environment. In the Southeast Asian region, the benefits of technological change to electric vehicles bring

many changes to the world's environment. As the electric vehicle industry grows, the government needs a new regulation related to climate change and also to reduce the occurrence of air pollution and in addition there is also an increase in energy supply.

The challenges that need to be faced in the Asian market also need to be taken into account because there are many positive developments related to the automotive manufacturing industry among Asian countries that are developing by establishing cooperation with the main players in the world's automotive manufacturing industry. Countries such as Korea, Japan, Thailand, Vietnam and Indonesia have also taken early steps to offer many models of electric and hybrid vehicles with the latest technology and in addition to designs that suit the tastes of today's consumers. By writing this article, we can analyze the current situation of the automotive market in selected Asian countries and present the direction of the market potential in the future. This article focuses on presenting how and what the benefits are regarding the transition to electric and hybrid vehicles. When the development of electric and hybrid vehicles takes place an important thing to consider is the method when the total global demand is increasing for vehicles and therefore also regarding fuel consumption and also air pollution. The state of greenhouse gas emissions and other harmful substances such as particulates, nitrogen, oxides and sulfur oxides in some urban areas. This Electric Vehicle Technology will also be used indirectly which will lead to better energy efficiency compared to existing conventional vehicles and will have a positive impact on the environment and also on human health in general.

In this matter the issue of the source of electricity generation needs to be clearly stated as one of the most important factors regarding electric vehicle policy and also in the case of the production of Battery Electric Vehicles may also emit more CO2 than conventional vehicles. One example is the research collaboration between the Japanese car manufacturer Mazda and Kogakuin University and has made estimates regarding the total CO2 emissions for conventional vehicles as well as electric vehicles in large countries such as China, Australia, Japan including continental Europe and the United States. state. From the research conducted, the results of the study found that BEV vehicles in Australia do not emit less CO2 than conventional vehicles and this is likely due to the country's heavy reliance on fossil fuels for electricity generation. While in China, Japan, the United States and continental Europe, some Conventional vehicles in certain circumstances will produce

less CO2 than BEVs. A comprehensive policy needs to be done regarding the development of this hybrid vehicle by studying and taking into account from all angles and various factors such as economic factors, technology, environment and also administrative and legal aspects for the electric marketability of the vehicle for ASEAN countries that need to be seen from various perspectives such as infrastructural, regulatory and legal challenges and most importantly is also the user approach because the user is the last part of this cycle. For developed and rich countries will remain in the electric vehicle market but overshadowed by a new giant that is rising rapidly today, which is China, not only for the domestic market but will become the global leader in a short time in the electric vehicle industry.

It is not unreasonable that major vehicle producing countries such as Korea, Japan and China recently aim to implement a zero carbon dioxide program and completely and completely stop the production of vehicles using conventional engine power in the future. This will also be followed by other countries in the region including ASEAN member countries. This revolutionary change will rapidly expand the entire automotive electric vehicle manufacturing industry and also impact other economic sectors related to vehicle manufacturing. electricity. This will make one of the important branches of transportation. Apart from progressive decisions and government policies and these will also be forced by global decisions made at cyclical climate conferences that define various goals. The Association of ASEAN countries is an organization that creates economic and political cooperation between 10 countries and this can be expected to take consistent action as done by other developed countries such as the European Union that makes certain climate goals and for countries that are ambitious in develop electricity. car industry. This article also presents collective data from expert studies, reports and analyses. This study has also been supplemented with literature analysis studies using deduction and inference methods as well as comparative data analysis methods. This article also combines the use of the scientific method with quantitative data obtained from industry reports.

What needs to be done before making an analysis about electric vehicles, which is about sales volume data and the structure of the electric car market, including the legal and administrative requirements to operate the infrastructure related to the manufacture of electric vehicles. The most important thing is to draw attention to the definition of this

electric car. .Because each research agency will issue opinions and views that may be different. Covering the above, it should be noted that it is basically considered an electric car and the basic type of vehicle can be distinguished including the type of vehicle.:

- BEV (Battery Electric Vehicle) is a vehicle that fully uses battery power to drive the vehicle where all the batteries are built and installed inside the vehicle.

- PHEV (Plug-in Hybrid Electric Vehicle) is a hybrid vehicle that uses a gasoline combustion engine and an electric motor as a power source to move the vehicle. This model can charge a high voltage battery to move using ICE and also recharge electricity from a charging point.

- FCEV (Fuel Cell Electric Vehicle) is a vehicle that uses hydrogen fuel. These models are also similar to Battery Electric Vehicle that use electric motors but they obtain energy in a completely different way. Instead of charging batteries, Fuel Cell Electric Vehicle store hydrogen gas in a tank. Fuel cells in Fuel Cell Electric Vehicle combine hydrogen with oxygen from the air. The power resulting from this reaction reaches the electric motor that will drive the vehicle as it happens in a Battery Electric Vehicle.

- A Hybrid Electric Vehicle (HEV) is a hybrid vehicle that uses two power sources to drive the vehicle but cannot recharge electricity from the grid and can recharge the high voltage battery generated by using a traditional internal combustion engine in the vehicle.

HEV model vehicles cannot be recharged by using from an external source and only the main drive motor is an internal combustion engine (ICE), while the electric motor is only an energy support unit to generate power obtained from regenerative braking and this vehicle is called a hybrid vehicle. This article only considers the first three types of vehicles, namely BEV, PHEV and FCEV. It should be noted that the production and sale of FCEV vehicles is very small and the number of these vehicles is not included in the official statistics due to the small scale amount (Figure 1).

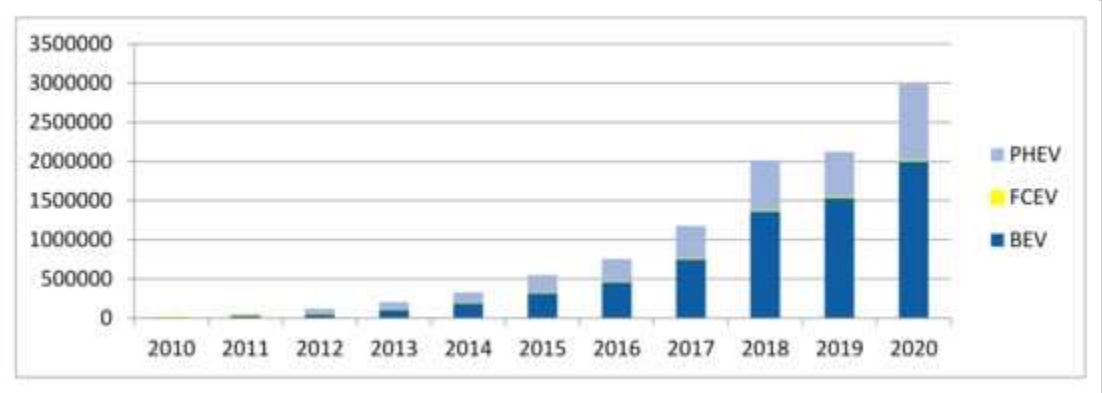


Figure 1. PHEV, BEV, and FCEV sales cars worldwide, 2010–2020.
Source: **https://www.iea.org/articles/global-ev-data-explorer** (accessed on 10 October 2021).

1.2 Problem Statement

The hybrid and electric vehicle industry has existed for almost 26 years in Malaysia, but the development and public acceptance of hybrid and electric vehicles has been somewhat less encouraging even though the government has given many tax discounts to producers and consumers. In addition, users can also save more than 50 percent of fuel consumption compared to conventional vehicles. Consumer awareness is very low about these hybrid and electric vehicles. The majority think that these hybrid and electric vehicles require high costs for maintenance in addition to higher unit sales prices compared to vehicles that use normal natural combustion engines. Workshop associations are also less encouraging because it will affect their business in the long run because these hybrid and electric vehicles do not need to be serviced and maintained. Now the price of Electric Vehicles is known to be quite high compared to conventional vehicles that use normal engines and this is also a challenge in fostering the widespread use of EVs. Malaysia aims for Electric Vehicles to account for more than 20% of total vehicle sales by the year 2025 and 50% by the year 2035. A more thorough study needs to be done to examine the issues that will cause the price of an electric vehicle. vehicles become so high and trying to find a solution to overcome the high price of electric vehicles. The price of electric vehicles in Malaysia is expensive compared to conventional cars. The estimated cost of an environmentally friendly vehicle such as the Myvi 1.5 L AV model is 23.7% cheaper than the MINI Cooper SE model with almost the same design condition. Meanwhile, the Nissan Leaf vehicle

model is 42% more expensive than the Nissan Almera model, which is a sedan type model with the same amount of cargo and passenger capacity. The very high price factor exceeds the conventional engine vehicle which causes users to think many times to own this electric vehicle. Consumers have long been exposed to conventional vehicles that use internal combustion engines since long ago when the automotive industry was established in Malaysia. Figure 2 shows a comparison between Electric Vehicles and conventional vehicles where the price difference is almost 12,000 USD between the price of an internal combustion engine and an electric vehicle. .The price difference factor is also due to the relatively low sales volume and in addition to the on-board electronics and electric motors used for electric vehicles. The basic indirect cost value of an electric vehicle is also higher than an internal combustion engine.

The single contributor to the car price difference is the cost of high voltage batteries which are very expensive these days. Reports have stated that the Nissan Leaf and BMWi3s models have a higher MSRP than the Ioniq HEV Plus, Jazz 1.5 Hybrid and Perodua Myvi 1.5 models. AT is high because the cost price of components for the construction of electric vehicles is very high during the manufacturing process compared to the disposal process of used materials. Direct cost prices and indirect cost prices for conventional vehicles and electric vehicles are often considered to affect the average price of each vehicle produced (Figure 2).

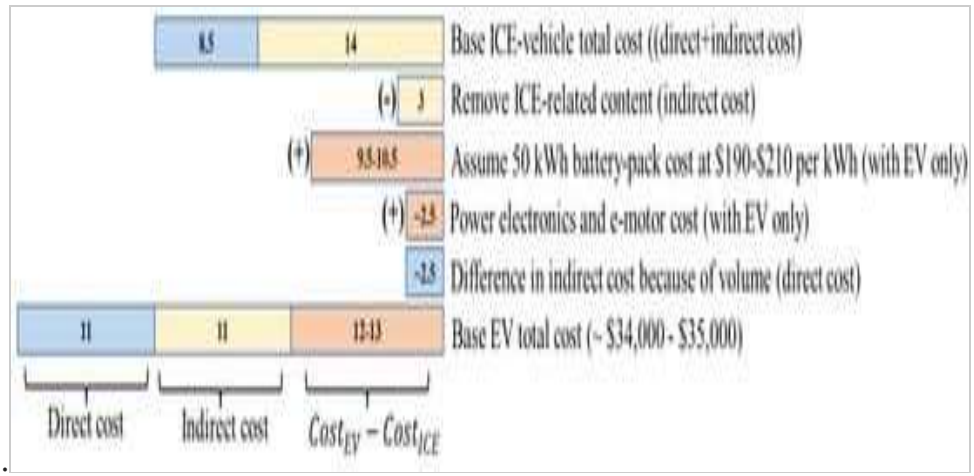


Figure 2. Estimated average cost per vehicle, in thousands of USD

Among the reasons why the price of electric vehicles is more expensive in the market is because the types and models available in the market are quite limited in the market of our country Malaysia and in addition the amount of tax imposed on these imported goods. car. There are not many electric vehicles sold in Malaysia, for example such as Nissan Leaf, BMW i3s, Mini Cooper Electric and others. Just like other developing countries, CBU vehicles are more expensive than CKD models in Malaysia. The CBU vehicle model is a car imported from a foreign country and it comes with a very high excise duty that can reach from 60% to 105% and this will indirectly increase the price of the vehicle when it reaches the consumer. As for the CKD unit, it is a car that will be assembled by a local manufacturing company that can be found and sold in Malaysia and this will make the price more affordable and cheaper for Malaysians to buy because it is eligible for reduced exemptions and incentives. from government excise duty.

1.3 Research Objectives

In order to get opinions from vehicle users in Malaysia about the advantages and benefits of using hybrid and electric vehicles in this country, a study needs to be done so that players in the automotive manufacturing industry and the government can work together in the development of affordable vehicles which uses hybrid and electric systems. This study is very important because for the development of this hybrid and electric vehicle because it requires very high costs in addition to high expertise and requires detailed studies from various aspects including planning, construction, production, marketing, sales, after sales service and also from many other aspects. Hybrid cars as a solution to energy saving and as a measure to reduce emissions are also receiving widespread attention. The motor drive system as an important part of the hybrid vehicle as an object and requires detailed study. Based on the hybrid electric vehicle power train control system for magnetic synchronous motors remains an object of study. Can be used for hybrid cars comparing traction motor characteristics, choosing a permanent magnet synchronous motor as the drive motor for hybrid vehicles. Construction of application in hybrid car in MATLAB/Simulink simulation model of permanent magnet synchronous motor speed control system and analysis of simulation results. Basically a research process will start with a brain storming session to get the best ideas to know what needs to be done next. Identifying the problem needs to be done in the initial study and done continuously to get the best results. After getting your research questions that have been refined, you can continue with the next process, which is to lay the foundation of the research design that will lead to a proposal that outlines the ideas and plans that have been planned. This article takes you through the first steps of the research process, helping you narrow down your ideas and build a solid foundation for your research project.

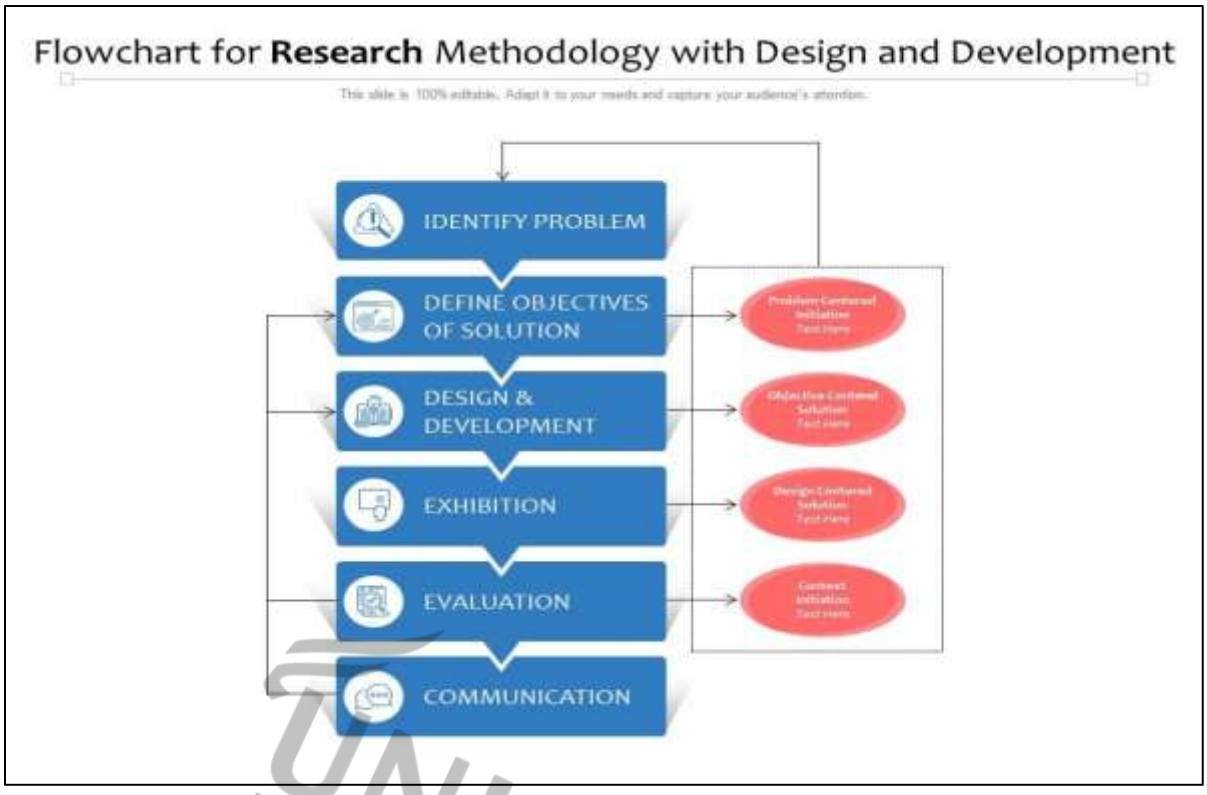


Figure 3. Research Methodology Flow

1.4 Research Questions

Research questions will revolve around vehicle prices, after-sales service, spare parts prices, used vehicle prices, comfort and resistance to weather conditions in Malaysia. Set universal criteria for good research questions. Different processes and disciplines give slightly different priorities and requirements. A good research question for a history paper for example will be different from a good research question for a biology paper. It should be for all quality research questions must be clear and focused. In easy-to-understand language, each question must clearly explain what the writer needs to do, which is not too big and not too small. Every good question must have a suitable scope because if a question is too big in scope, then maybe the question cannot be answered correctly according to the requirements of the question. Even if the proposed question is too narrow then you will not have enough space and time to write and also you will struggle to develop a strong argument. It should also not be too easy to answer and for example the question requires more than a simple yes or no answer which makes it not too difficult in the process of giving an answer. Your requirement is that you must be able to answer the questions

thoroughly with the time and word limit set. The study can be done and you must have access to an appropriate amount of quality research material such as academic books and even refereed journal articles. Analytical and not descriptive. In addition, each of your research questions should allow you to produce an analysis of the issue or problem rather than a simple description of it.

Purpose of the study	*Research question*	*Research strategy*	*Example of collection techniques*
EXPLORATORY • To investigate little understood phenomena • To identify/discover important variables • To generate hypotheses for further research	• What is happening in the industry? • What are salient themes, patters, categories in participants' meaning structures? • How are these patterns linked with one another?	• Case study • Field study	• Participant observation • In-depth interviewing • Expert opinion • Focus groups
EXPLANATORY • To explain the forces causing the phenomenon in question • To identify plausible causal networks shaping the phenomenon	• What events, beliefs, attitudes, policies are shaping this phenomenon? • How do these forces interact to result in the phenomenon?	• Multisite case study • History • Field study • Ethnography	• Participant observation • In-depth interviewing • Survey questionnaire • Document analysis
DESCRIPTIVE • To document the phenomenon of interest	• What are the salient behaviours, events, attitudes, structures, processes occurring in this phenomenon?	• Case study • Field study • Ethnography	• Participant observation • In-depth interviewing • Document analysis • Unobtrusive measures • Survey questionnaire
PREDICTIVE • To predict the outcomes of the phenomenon • To forecast the events and behaviours resulting from the phenomenon	• What will occur as a result of this phenomenon? • Who will be affected? • In what ways?	• Experiment • Quasi experiment	• Survey questionnaire (large sample) • Kinesics • Content analysis

Source: Marshall and Rossman, 1989

Figure 4. Research Question sample

Figure 5. Characteristics of a strong research question

1.5 Significance of the Study

The thoroughness of this study is necessary because the majority of hybrid and electric vehicles are developed and produced in other countries such as European countries and China and may not be suitable for Malaysia's weather conditions which have extreme heat and rain. This is important because the vehicle produced will be well received by consumers. Accuracy is very important in the development of this hybrid and electric vehicle because it needs to be emphasized in terms of the safety of the driver, passengers, other drivers and also the security team that manages this hybrid vehicle in case of any unexpected accidents and disasters. Proper methods must be taken to operate these hybrid and electric vehicles because they involve high voltages that require expertise in handling in various situations. Knowledge and skills are essential to operate in an emergency situation so that everyone involved is safe and nothing happens undesirable. Cooperation from producers and the government is necessary to launch all the plans made.

1.6 The Organisation of the Study

In general, the Organizational component of the study is to highlight the position of the organization that will be sought in the next chapters. In particular, the Study Organization component is to briefly establish how each chapter is organized to achieve your research objectives. Organizational research is an academic field that is biased towards collective activity and how it relates to organization and management. It is an examination in which individuals build organizational structures, processes and practices and then form social relationships and create institutions that ultimately affect humanity. Organizational studies conducted also consist of different fields that deal with various aspects of organizations and most approaches are functional but critical research also provides an alternative framework for understanding in the field. Basically, the study of management is change to an organization and historically. Facilitating organizational change has proven to be quite a difficult subject and that is why different theoretical frameworks have been developed in an attempt to adapt the process strategically such as using external actors or temporary organizations where it is important to determine any decision that will change expectations before doing the work and can also prepare the next plan.

Figure 6. Organizational Studies

The first sentence or two should introduce the study, followed by a statement of the study's purpose. The main content of the following abstract is a summary of your main results and conclusions. A concluding sentence or two should be devoted to the significance of your findings. What is most important is the basic structure of every typical research paper which includes the introduction of the topic, the implementation method, the results of the survey and the discussion of each result. In each section, they deal with different objectives and what they think is the best outcome of the discussions held together. Organizational Studies is a multidisciplinary activity that brings together research concepts and methodologies from social psychology, sociology, anthropology and other social sciences.

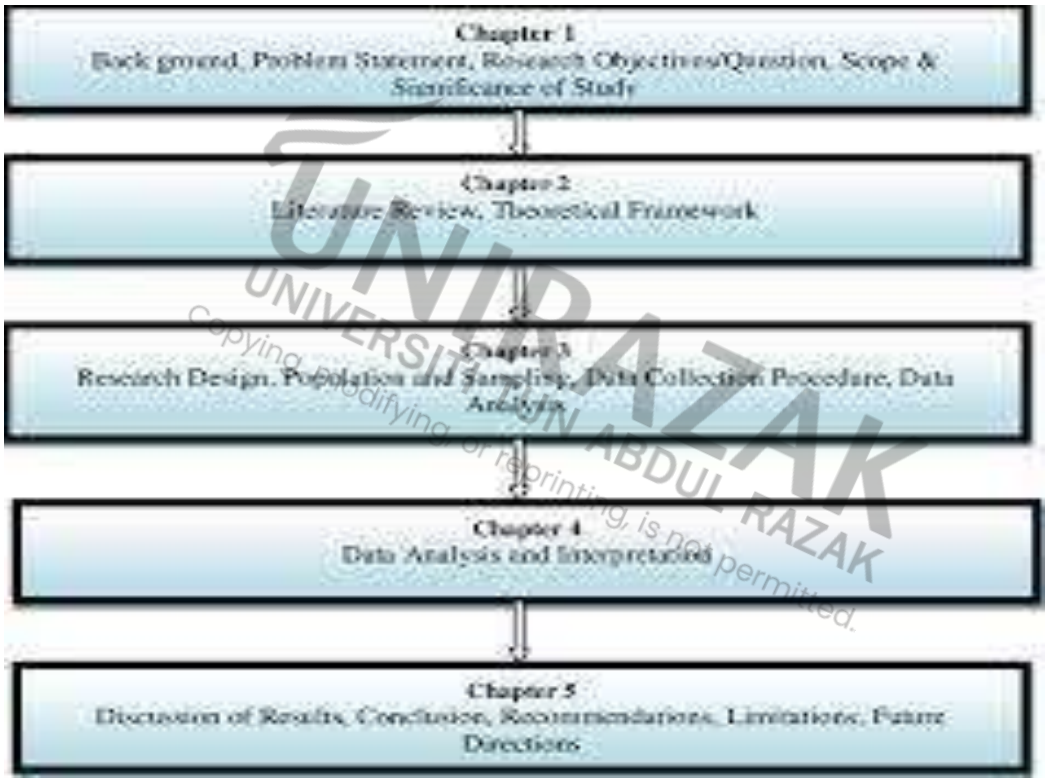


Figure 7. Scentific Digram

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature review has referred to past studies and articles on hybrid and electric vehicles to obtain references and improvements to produce future products. This study is important for reference and comparison for improvement in terms of existing products and processes. Through this reference we also get ideas to produce new products with better quality and more durable results. This past research reference can also examine how to better produce hybrid and electric vehicle products because these vehicles use high voltage (HV) as power resources to drive a vehicle. The prediction that has been made by the Malaysian Automotive Association (MAA) that the total industry volume (TIV) will decrease by 9.8% by 2023 after passing the level of 700,000 by 2022. The annual TIV is also expected to decrease from a total of 720,658 units by year 2022 to 650,000 units by 2023 the end of the sales tax exemption. According to a statement issued on March 31, 2023 by MAA President Datuk Aishah Ahmad." Some industry players and companies have also stated that there may be a slow number of orders after the sales tax exemption is no longer available," he told the media at a press conference. The MAA president shared that the government cannot extend the sales tax exemption because it has been made for three years following the addition of the epidemic. In the pandemic situation of Covid-19, the players of the automotive industry will continue to face various challenges and supply chain issues such as the lack of semiconductor chips and also the uncertainty in the geopolitical situation and the possibility of the recurrence of Covid-19 cases around the world which will undoubtedly affect all the economic growth of the country and beyond the performance of the new vehicle sales industry will also be affected.

The price of raw materials will continue to rise. Our ringgit has also weakened other currencies. The higher annual TIV in 2022 is due to demand for new vehicles mostly in the first half of 2022 and continues to increase following the authorities' decision to allow buyers with confirmed reservations with sales tax exemption and submitted before June 30, 2022 to register their new passenger cars. As for the Proton model, there are 136,026

units, while the Toyota model is 100,041 units, the Honda model is 80,290 units and the Mitsubishi model is only 24,017 units. Passenger vehicles which are cars have increased to 641,773 units by 2022 and increased from 452,486 units by 2021. .For the commercial vehicle segment also shows an increase in new registrations that will increase to 78,885 units by 2022 from 56,397 units in the previous year because the Bega N company will invest after two economic recovery expectations that have decreased due to the Covid-19 Pandemic. Meanwhile, Bontara TIV also reached the highest level of 76,657 units in December 2022 compared to 65,201 units in November 2022. Appeals to extend incentives for electric vehicles (EV) until 2030 and Aishah said the number of electric vehicles (EV) sold is expected to increase this year as many new models are launched and the tax incentive will further boost electric vehicle (EV) sales. MAA has also appealed to the government to extend incentives for EVS - import duty and excise exemption for a longer period and if possible until 2030. Last October under the administration of former Prime Minister Datuk Seri Ismail Sabri Yaakob announced the extension of import tax and excise exemption on electric vehicles (EV) until the end of December 2024 for electric vehicles (EV) that have been completed and fully tapped to encourage the use of electric vehicles (EV) in Malaysia.

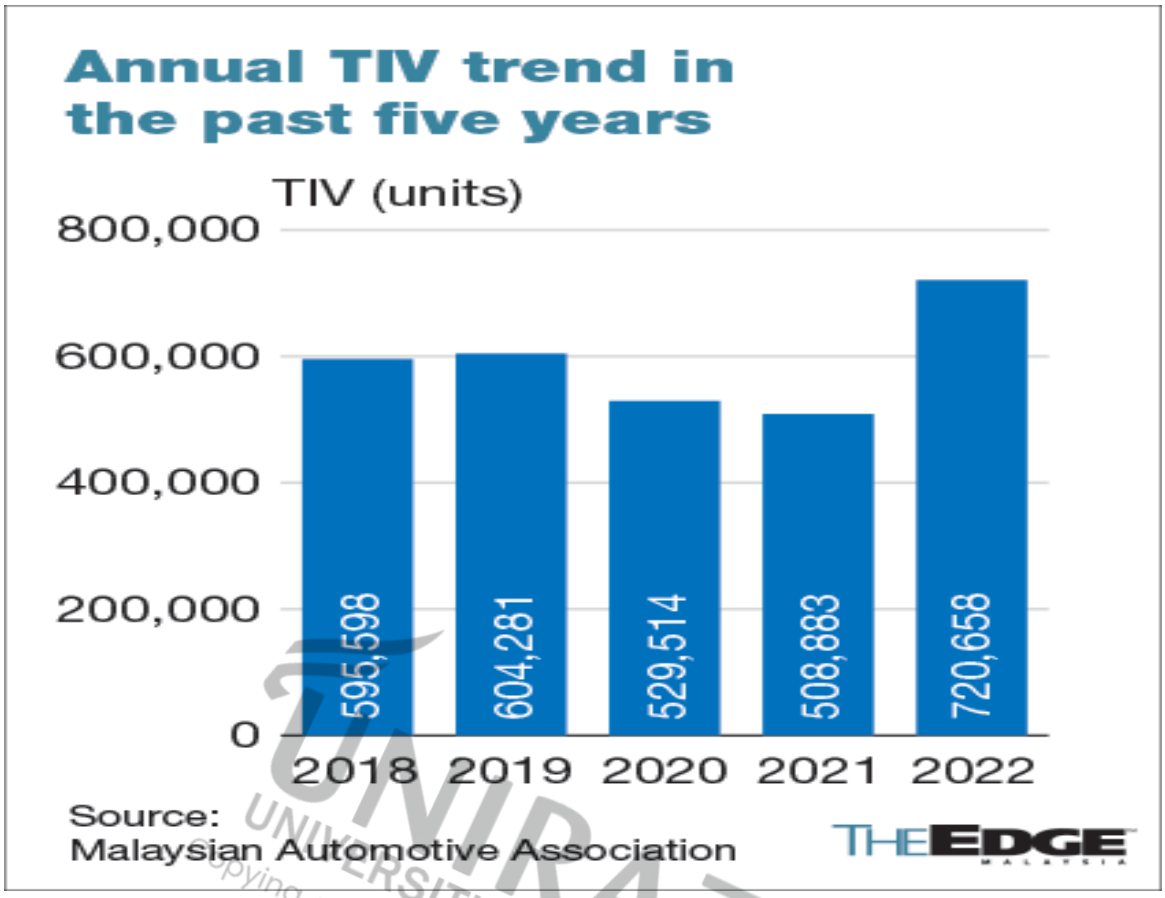


Figure 8 . MAA Forecast lower vehicle sale 2023

2.2 Theoretical Foundation

Basically a theory is a formal theoretical model that can be used to explain issues that help your research. We often start a dissertation with a question that can be quite confusing or an observation that something has been overlooked. A dissertation is our attempt to use existing theoretical methods to refine the question to determine the method of finding answers. The theoretical basis will also be able to help find a greater solution and clarity to this problem is a first step towards doing so. Usually the theoretical basis consists of one or more. Usually not all critical papers and scientific works academics and arguments will be made theoretically only, which is scientific or humanistic and theory is the intellectual basis, which is the basis of built research. The method of finding references on any part will be a reference to be a guide for the writer to write.

2.3 Empirical Research

The process of empirical research can be defined like any research that is it can be concluded that the study is derived from strong empirical evidence and the confirmation of the evidence found is strong. The way or method of collecting empirical evidence is through quantitative market research methods and also through qualitative market research methods. The therapy method of listening to cheerful music while working can make an employee more creative. The study was conducted using a music site survey method to the audience exposed to upbeat music and another group that did not listen to any music at all and the results were observed. The results that will be obtained from this research study will provide empirical evidence whether it increases employee creativity or not. This empirical study can also be conducted and analyzed using qualitative or quantitative methods. Quantitative research is a research method used to collect information through data. It is also used to measure opinions, behaviors or certain variables. The set format will be more systematic and there are some commonly used methods such as surveys, conducting longitudinal studies, sampling and others. Qualitative Research is a qualitative research method used to find and collect numerical data. This method is used to find the meaning, opinion or basic reason for a subject and this method is called unstructured or structured For the sample size for this kind of study is usually small and it is a kind of conversational method to provide more in-depth information about the problem and the usual methods that are always used are interviews, focus, experiments and others. All the data that has been collected will be analyzed and also the empirical evidence can be analyzed either quantitatively or qualitatively. From the use of this method, the researcher can answer empirical questions that must be clearly defined and responsible for everything that has been found. There are various types of research that are used according to the suitability of the intended field. Most will choose to do collective research that will involve quantitative and qualitative methods to all answer questions that cannot be better studied in a laboratory setting.

Figure 9 . Empirical Research

2.4 Proposed Conceptual Framework

The main focus of the study is on the implementation challenges to create a culture of Electric Vehicles in Malaysia and also to address and find solutions to face every challenge that will be faced in the future. A comprehensive research consisting of selected data collected from the literature, Malaysian official reports and data from industry players regarding electric vehicles as well as providing recommendations for making changes in operations, manufacturing industry and supporting policy formulation to increase the interest of large-scale electric vehicle users in the Malaysian context. In order to make a selection of relevant literature for the writer to plan the best strategy. The first thing is to address the main challenges to the growth of electric vehicles more widely throughout Malaysia. The second point is that each challenge and risk is taken and also divided into components and important factors to address and solve these challenges. Relevant literature studies have been searched and analyzed in detail to find solutions to be implemented for the development of the Malaysian economy. This is to show the importance and address each of the same challenges in other countries whose economy and socio-culture are similar

to Malaysia, such as Singapore, South Korea, Japan and China. If there is no work located on the issue at hand and the company's data is strong in terms of theory and also the original thesis work and also the implementation of both current technologies are considered to provide potential solutions to the challenge and pave the way for further original research to address the issue. Finally, the author has asked a variety of questions about expansion planning from the basic level, prospects and levels of customer satisfaction to local manufacturing companies and researchers. The framework of the study is summarized in the flow diagram shown in Figure 10.

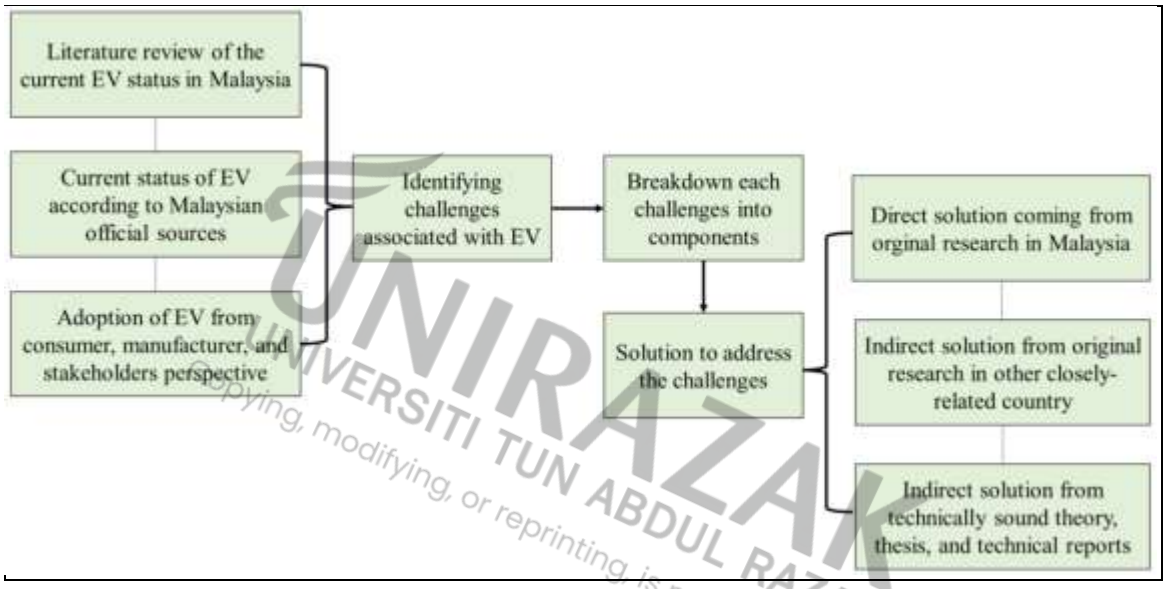


Figure 10. Research Framework.

The purpose of this study is to consider a more structured method and way to review the current literature and summarize the prospects, challenges that will be faced and possible solutions for the wider use of electric vehicles throughout Malaysia. First, a collection of relevant literature was created from the search results of keywords consisting of electric vehicles, Malaysia policy, growth conditions, challenges and prospects. A collection of original article models and reviews that have been refined and narrowed down between 2015 and 2020. The original articles are organized according to the specific issues and challenges they are trying to address related to the manufacturing process of electric vehicles including battery management and also electric vehicle infrastructure in Malaysia

including government policy for electric vehicles in Malaysia .In addition to that the trend towards electric vehicle culture from the perspective of users and stakeholders also .The process considered here corresponds to the reference and is shown in Figure 11.

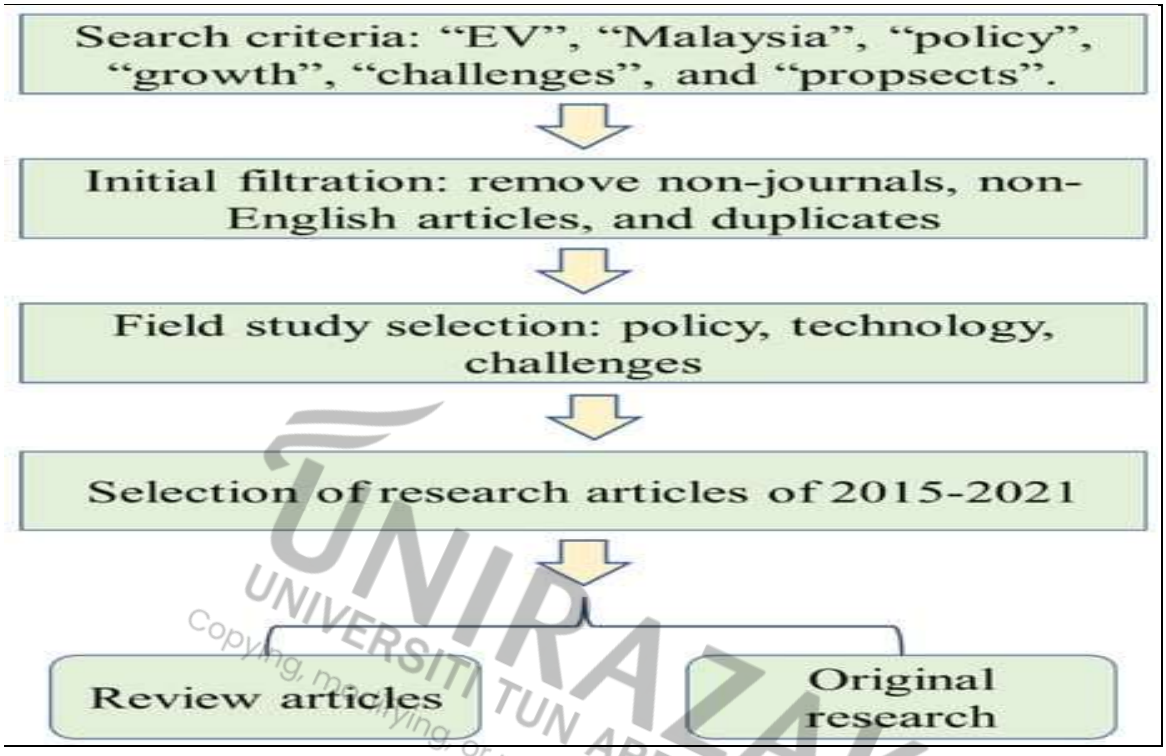


Figure 11. Literature review process

2.5 Hypothesis Development

A hypothesis is a prediction that is specifically related to the conduct of a particular study. Developmental habits are carried out by taking into account and considering every available evidence and also using reasoning to draw conclusions about what will happen in a context for a particular interest. These hypotheses are also often but not always theories. A hypothesis is a specific prediction about a new phenomenon that requires attention if a theory is correct. An explanation that will only depend on a few key concepts. A hypothesis is often a specific prediction of what will happen in a particular study. It is developed by considering the available evidence and using reasoning to infer what will happen in a given context of interest. Hypotheses are often but not always theories.A

hypothesis is an expectation that is guided by a theory but there are some hypotheses that are the A test and only after a set of observations are made and the theory is developed. This is because the theories are broad and they describe a larger body of data. Therefore, if one of our research questions is true, it is necessary to collect some data and make some observations before developing a broader theory.One of the methods used is to pose a research question using the techniques discussed in this chapter and then ask if there is a theory that implies an answer to the question. For example you might wonder about expressing expressive writing about positive and health-enhancing experiences as expressive writing about traumatic experiences. Although this question is interesting and it may be possible to ask whether the idea of Conditioning Theory that Expressive Writing causes people to become accustomed to negative thoughts and feelings provides an answer. In this case it seems clear that if the Conditioning Theory is correct then expressive writing about positive experiences should not be effective because it will not cause people to become accustomed to negative thoughts and feelings. The second way to derive hypotheses from theories is to focus on some component of the theory that has not been directly observed. For example, researchers could focus on adaptation processes that might hypothesize that people should show some signs of emotional stress with each new writing session.

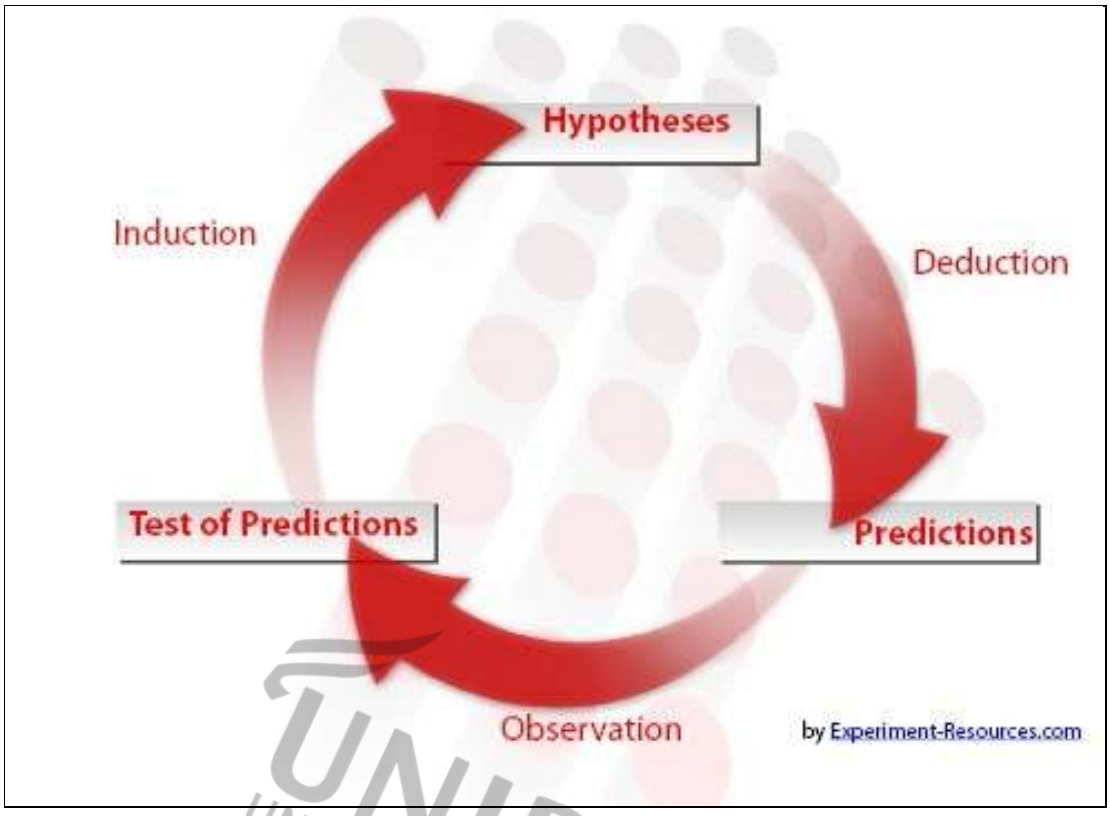


Figure 12. Research Hypothesis

Figure 13. Checklist Evaluate Research Hypothesis

2.6 Summary of Chapter 2

The entire literature review process for part two is conducted in the correct format and study to get the most powerful and able to make the best decision. The best products and services in the future. With the existing formula can find the right steps to face the challenges of hybrid and electric vehicles in the future and will also produce positive results. Consumers are confident in products that are safe to use.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The research carried out is based on a face-to-face review, by filling out forms, via email, Google Forms and the results of the analysis will be made to determine what needs to be done for the next process so that the product is produced and released. And further meet user needs involving applied research in the field and the theory or principles behind it, to develop an approach that fits your objectives. In the process of collecting and analyzing data, there is a need for proper methods and procedures. Data collection methods can be used in several main types, namely through observation methods, doing experiments, making simulations and issuing publications. The data that has been collected will be analyzed to get accurate results. This research methodology is one of the ways to make a description and how researchers intend to conduct their research. It is a more systematic plan that can be used to solve problems encountered in the process of doing research. The methodology used is more detailed and authentic so that the results of the study get reliable and accurate results in order to achieve the goals of the research study in addition to data that can be used. This data collection also takes into account how the data is taken and where the data is taken so that the results can be correct and accurate. The methodology of a form of research will give legitimacy to the research and provide scientific findings. This will also provide a more detailed plan to help and ensure that each researcher is always on the right track to make the process run smoothly and effectively and always under control. The methodology of this study will allow everyone to understand the methods and concepts used as well as good and accurate conclusions. The Methodology of each research needs to be well prepared and will provide the following benefits, that is, other researchers who want to make our research results a reference and the information we produce is accurate and factual. The design process and methodological methods will help the researcher choose the method that suits the objective. In addition, it can also help researchers document what they want to achieve with each research done from the beginning.

3.2 Research Design

In the methodological planning process of a research and a researcher will have several options to make any decision. The important method is the data methodology used, qualitative, quantitative or a combination of these two methods. Any type or method of research and the data found is numerical or descriptive and the researcher can also choose to focus on a collection of words, numbers or both.

Qualitative

The qualitative research process also involves collecting and analyzing data related to words and also in the form of written or oral texts. This method is also focused on body language or visual elements that can help and create a detailed explanation of the results of the observations obtained by the researchers. The researchers will collect qualitative data through interviews, observations and focus groups using a number of randomly selected participants. carefully Method The methodology of this study is subjective and will take longer than using quantitative data. Researchers also often use qualitative methodology when the goal and objective of the research is exploration. For example when a researcher conducts research to understand human perception of events, people or a product.

Quantity

Researchers will usually use quantitative methodology when the objective of the study is to confirm something. It will be more focused on collecting, testing and measuring numerical data and usually from a large sample of candidates. The data set will be analyzed using statistical and comparative analysis methods. Popular ways and methods used for quantitative data collection are:

- Review
- Questionnaire
- Inspection
- Data base
- Organizational Record Keeping

The methodology of this study is objective and researchers usually use software methods to analyze data. An example is that researchers can also conduct research using quantitative methodology to measure the degree of relationship between two variables or to test a set of hypotheses.

Figure 14. Characteristics of Research Design

3.3 Study Population and Sampling Procedures

When creating a sample form the researcher made a decision from the researcher who collected the data. How to choose the techniques and procedures to be used to select items or individuals for sampling. There are several types of sample designs that fall into two main categories.

Probability sampling

This sampling method that uses a random sample of a group or something of interest is called population and random or opportunity sampling. Everyone in the population has an equal chance of being selected. The best way to get a really good quality sample so that the researcher can do the study and produce a good result for all parties.

Sampling is not a probability

The sample taken is selected for the researcher to make a sample for the purpose of the study. Researchers also refer to this method as purposive sampling, judicial sampling or

purposive sampling. For each item in the population does not have an equal chance of being selected and the results usually cannot be generalized to the entire population.

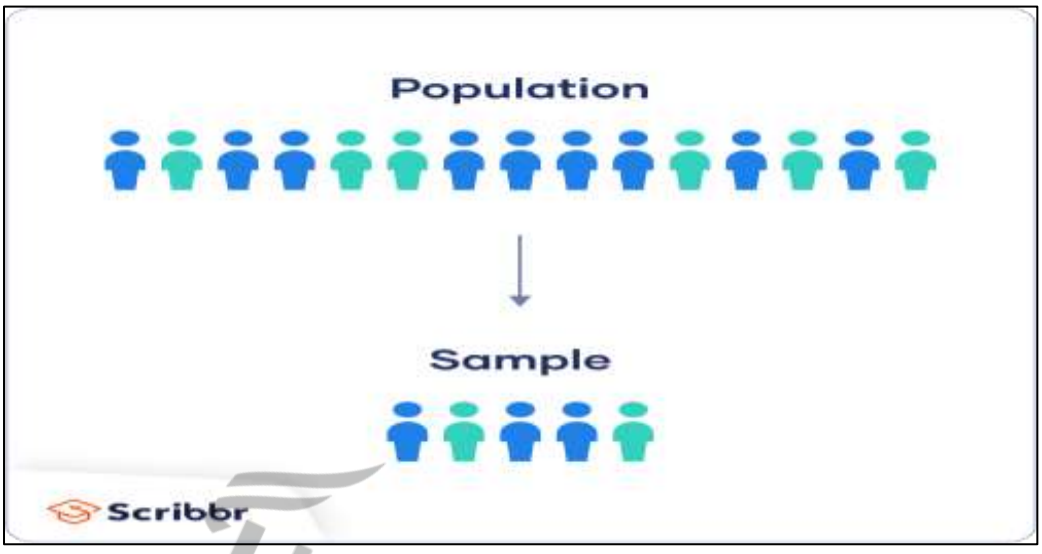


Figure 15. Sampling Method

Types of Sampling Methods

Sampling Method	Description	Example
Random Sampling	• Gathering a representative sample from a population where each member in the population has an **equal chance** of being selected.	• Using a **random number generator** to select students in a class to complete a task.
Stratified Sampling	• Smaller groups or **strata** within the sample are represented **proportionally** to the population.	• Finding out a favourite soap opera from different age **categories** of people in a year group.
Systematic Sampling	• Every member in the population is given a **number**. After the first member is chosen at random, the remaining members are chosen from a given **interval**.	• A **list of people** with their first names in alphabetical order are numbered. The 5th person is **chosen randomly**, followed by every subsequent 8th person.
Non Random Sampling	• **Convenience** sampling is used for **ease** of data collection. **Volunteers** usually collect data.	• Asking people at a given location about how long their commute to work is.
Capture Recapture	• **Collecting** a sample of data from **one location** at **different points in time, marking** the individuals to estimate a population size.	• A sample of woodlice were **captured, marked and released**. Another sample of woodlice was captured 5 days later and the number of marked woodlice was counted.

Figure 16. |Type of Sampling Method

3.4 Data Collection Method

Each study conducted by the researcher will finalize each sample that has been received and ensure the best way of data collection. Many choices can be made for all processes including data collection and the best research methods to use for the research topic, methodology, data types and even population samples. Although there are many ways to collect data, and researchers spend a lot of time using these methods:

Interviews: Researchers can use the interview method in a structured, semi-structured or unstructured format and depending on the form of the questions to be concluded.

Surveys: Survey methods can also be done online or in person and have essay-style or closed-ended multiple-choice questions. This also depends on the data required and the survey can also use a mixture.

Focus groups: The focus is more on the group for interview sessions related to how to think, give opinions, perspectives and perceptions about a topic. Usually a moderator will bring the group together to help guide, discuss and ensure that everyone involved is given the opportunity to share their thoughts.

Observation: This direct observation method involves observing the candidate's spontaneous behavior without interference from the researcher and while the participant observation is more structured and the researcher interacts with the participant.

Documents and Records: The researchers will collect necessary data such as published reports and official documents of international bodies, government agencies or private institutions and internal records such as employee salaries, quantities of raw materials and cash receipts.

Figure 17. Data Collection Method

3.5 Operationalisation and Measurement

Research Objectives: The objective of the research project is to find out the information needed at the end of the project to meet the main objectives of the research in order to be able to choose the right research methodology.

Importance of Statistics: The most important thing to consider is to ensure that every result and answer is the result of a simple, easy and accurate statistical study. Research questions also require an understanding of reasons, perceptions, opinions and provide motivation.

Nature of the research: The aims and objectives are research explorations that require qualitative data collection methods. However, if the goal and objective is to measure or test something, then every research needs quantitative data collection methods.

Sample size: The amount of sample should be sufficient to make the research question so that it fulfills and ensures that the objective is achieved. Data collection can also be determined by using the right sample size such as using personal interview methods or smaller samples or online reviews for larger ones.

Time available: Techniques such as random sampling or facilities and tools that allow data collection in a few days if there is a shortage and insufficiency of time. Interview methods and personal observations can also be done if there is enough time to do those things.

Figure 18. Conceptualization versus Operationalization

Variables	Measurement	Abbreviations	Hypothesis
Dependent variable			
Return on asset	Net Income/ Total Assets	ROA	Positive /Negative
Return on equity	Net Income-Preferency Dividend / Total Ordinary Equity	ROE	Positive /Negative
Gross profit margin	Gross profit/Net sales	GPM	Positive /Negative
Independent variable			
Inventory conversion period	Inventory/ Cost of Goods Sold * 365	ICP	Positive /Negative
Receivables collection days	Account Receivable/Net Sales*365	ACP	Positive /Negative
Payables payment days	Accounts Payable/ Purchases* 365	APP	Positive /Negative
Cash conversion cycle	ACP + ICP – APP	CCC	Positive /Negative
Gross Working Capital	Net Sales/ Current Assets	GWC	Positive /Negative
Current Assets to Total Assets Ratio	Current Assets/ Total Assets	CATA	Positive /Negative
Current Liabilities to Total Liabilities Ratio	Current Liabilities/Total Liabilities	CLTL	Positive /Negative
Current Ratio	Current Assets/ Current Liabilities	CR	Positive /Negative

Figure 19. Measurement

3.5.1 Independent Variables

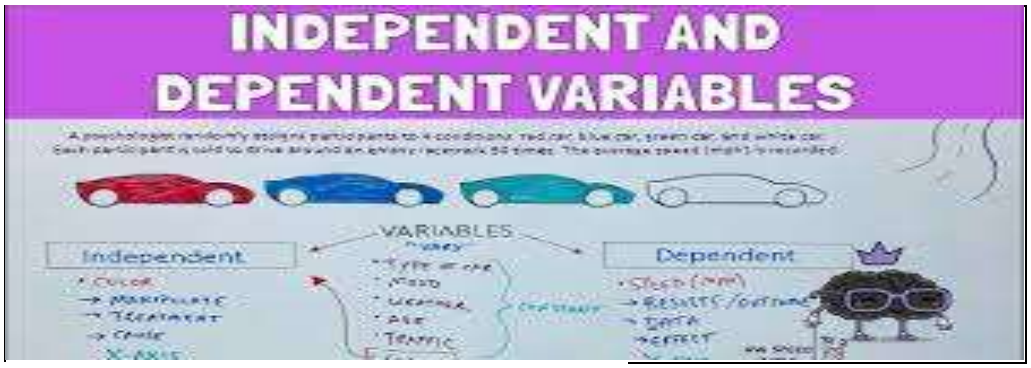


Figure 20. Independent and Dependent Variable

3.5.2 Mediating Variable

Figure 21. Mediating Variable

3.5.3 Dependent Variable

Figure 22. Dependent Variable

3.6 Data Analysis Techniques

Researchers have used different data analysis methods depending on whether the data is qualitative or quantitative. For example

Qualitative Data Analysis: Qualitative data usually takes the form of oral or written information, such as interview transcripts, through video and audio recordings, notes, images and text documents. This qualitative data analysis also involves how to identify any response from the candidate and then make a critical analysis to achieve all the goals and objectives of the study. The most commonly used qualitative data analysis method is:

Content Analysis: Common methods are used to analyze any information that will be recorded and are usually used to analyze interviews.

Narrative Analysis: The researcher has used this method to analyze the content that has been found from several sources including through interview sessions, observationally and also through surveys. In addition, the focus is also given to those who use stories and through the candidate's experience to answer the research questions.

Discourse Analysis: Using this method can also analyze spoken or written language in a social context and also give an understanding of how to use language in everyday situations.

Grounded Theory: This method also uses qualitative data to discover and build theories that will explain how and why something happened. It also uses comparative analysis of data from the same case in different conditions to obtain certain certainty.

Quantitative data analysis: This method and way of doing quantitative data analysis involves converting numbers into accurate data with rational and critical thinking. Researchers typically use many software analysis methods to aid quantitative data analysis. The first stage in making quantitative data analysis is by way of verification, editing and coding of all the data obtained. After completion the data is ready for analysis.

The most commonly used quantitative data analysis method.

Descriptive analysis: This is also one of the methods used which is by using descriptive statistics such as mean, median, mode, percentage, frequency and range to find patterns.

Inferential Analysis: This method can also show the relationship between various variables by using correlation, regression and variance.

Figure 23. Data Analysis Techniques

Figure 24. Data Analysis Process

3.7 Summary of Chapter 3

The entire development methodology process of Chapter 3 went smoothly by following the correct method. The next process is to get customer data to conduct surveys to collect surveys. has been referred to the correct and quality results. Research design methods such as using a complete survey form with complete info and sampling from the relevant consumer population in the Target Market Survey. Data Collection is also obtained through interview sessions, surveys, focus groups, observations and documents and records. Data analysis also uses the best techniques to produce accurate data.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

In order to complete this study properly and completely, it is necessary to analyze the data that has been collected to test the hypothesis to answer the research question. As has been shown in the previous chapter, the data has been interpreted in descriptive form. This chapter has also included the analysis, presentation and interpretation of the results of this study. The analysis and interpretation of data has been carried out in two phases, namely in the first part which is based on the results of the questionnaire and has talked about quantitative data analysis. The second point is that the results from the interviews and group discussions are qualitative interpretations. The data taken from the respondents should also be from all backgrounds so that the data taken later includes various layers of society and users to get good and accurate results. This matter is very important because the data taken is not from the same industry sector but different with the background of the job and region including the race and ethnicity of the population. The total data of this survey was taken from 150 to 200 respondents to get input and opinions from all respondents from various walks of life to complete the study and analysis involving the topic of Challenges of the hybrid and electric vehicle industry in the Malaysian Automotive Market in the Next 5 Years.

4.2 Descriptive Analysis

Nowadays Big Data and Data Science have become high volume buzzwords. They tend to be widely studied and this makes this data processed and studied carefully. This is also one of the techniques to analyze this data is Descriptive Analysis. This data needs to be analyzed to provide solid insights and influential trends that allow the next set of content to be tailored to the likes or dislikes of the general population. This data collection is also used in descriptive analysis. to generate historical data. In recording according to data categories, that is, data is collected first and then filled in to make the data set easier to manage. Descriptive techniques often include constructing tables of quantiles and means, scatter plots such as variance or standard deviation, and cross-tabulations that can be used to test various hypotheses. These hypotheses often highlight differences between subgroups. Measures such as segregation, discrimination and inequality are studied using specific descriptive techniques. Discrimination is measured with the help of audit studies or decomposition methods. More segregation based on type or inequality of outcomes is not necessarily entirely good or bad, but it is often considered a marker of unjust social processes; accurate measurement of different steps across space and time is a prerequisite for understanding this process.

A table of mean by subgroup is used to show significant differences across subgroups, which mostly result in inferences and conclusions being drawn. When we see a gap in income, for example, we naturally tend to extrapolate reasons for conforming to that pattern. But this also enters the territory of measuring impact which requires the use of different techniques. Often, random variation causes differences in means, and statistical inference is needed to determine whether observed differences may be due to chance alone. A cross or two-way tabulation should show the proportion of components with unique values for each of the two available variables, or cell proportions. For example, we might tabulate the proportion of the population that has a high school degree and also receives food or cash assistance, meaning a cross-tab of education versus receipt of assistance should be made. Then we might also want to examine the proportion of rows, or fractions in each education group that receive food or cash assistance, perhaps seeing that the level of

assistance declines sharply at higher education levels. Column proportions can also be examined, for population fractions with different levels of education, but this is against any causal effect. We may find a very high number or share of recipients with a college education, but this may be due to the greater number of college graduates than those with a primary school degree. For this survey, several key questions were asked for customers related to the topic of Hybrid and Electric Vehicle Industry Challenges in the Malaysian Automotive Market in the Next 5 Years, namely questions about customer demographics, the level of awareness about hybrid and electric vehicles, the price of hybrid and electric vehicles, hybrid and electric vehicle parts, electric vehicle charging facilities and service and maintenance.

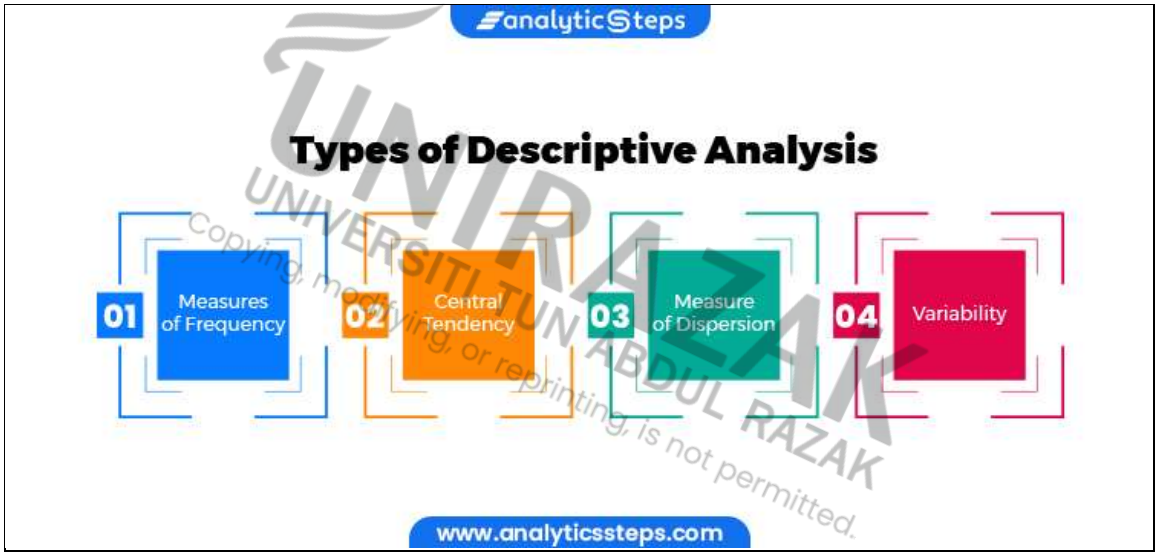


Figure 25. Type of Descriptive Analysis

4.2.1 Demographic of Respondents

As for the demographic question section, it has been divided into several related questions to obtain optimal and effective results. The questions asked are such as gender, age, race, marital status, highest level of education, employment status, employment sector, salary range or monthly income. , are users and owners of motor vehicles, the type of motor vehicle owned and whether the user has a hybrid or electric vehicle. Out of a total of 205

surveys made for the gender section, the highest number is male which is 76% while female is only 23.5%. For the age category, the highest number during the survey is 35-44 years old which is 34.6% while the second highest is the 45-54 year old age group which is 27.8% and for the 25-34 year old age group only 19 years old. % and the rest aged 55 and over amounting to 18.6%. For the race category and the highest number is the Malay race 87.8% followed by other races which is 12.2% such as Chinese, Indians and others. While for the marital status of the survey, the highest respondents were married, 72.2% and single 27.3%. For the level of education, the highest level is the diploma level which is 41.9% and the bachelor level 21.2%. For high school graduates only 15.8% and the rest Master's and PHD level which is 21.1%. For the employment status category, 72.1% are for full-time workers and while the self-employed amount to 10.8% and the rest are unemployed, students and retirees amount to 17.1%. While for the employment sector category, the highest number is private workers which is 60.3% followed by government employees which is 16.7% while the rest are self-employed and not applicable as much as 23%.

For the range of salary or monthly income, 31.8% is below RM2,500 and 21.4% for income from RM3,501 to RM4,500. For the third highest income is RM2,501 to RM3,500 which is 16.9%. For the fourth highest income is RM8,501 and above which is 10.4% and the rest is income between RM4,501 to RM8,500 which is 29.9%.

While the response of those who have a vehicle or owner of a motor vehicle is the highest which is 97.5% and non-users or owners of a motor vehicle is only 2.5%. The highest type of motor vehicle is the car type which is 77.6% while motorcycles are only 13.9%. The rest such as motor vehicles such as vans, multi-purpose vehicles (MPVs), sports utility vehicles (SUVs), pickups and trucks are only 8.5%. For the last demographic question, the number of respondents who use hybrid vehicles is very unimpressive and also low because only 6.4% of 204 respondents use hybrid or electric vehicles and this number is very low compared to the use of normal vehicles which is 93.6% and this shows the awareness and ability of users using hybrid and electric vehicles is still too far for the market in our country Malaysia.

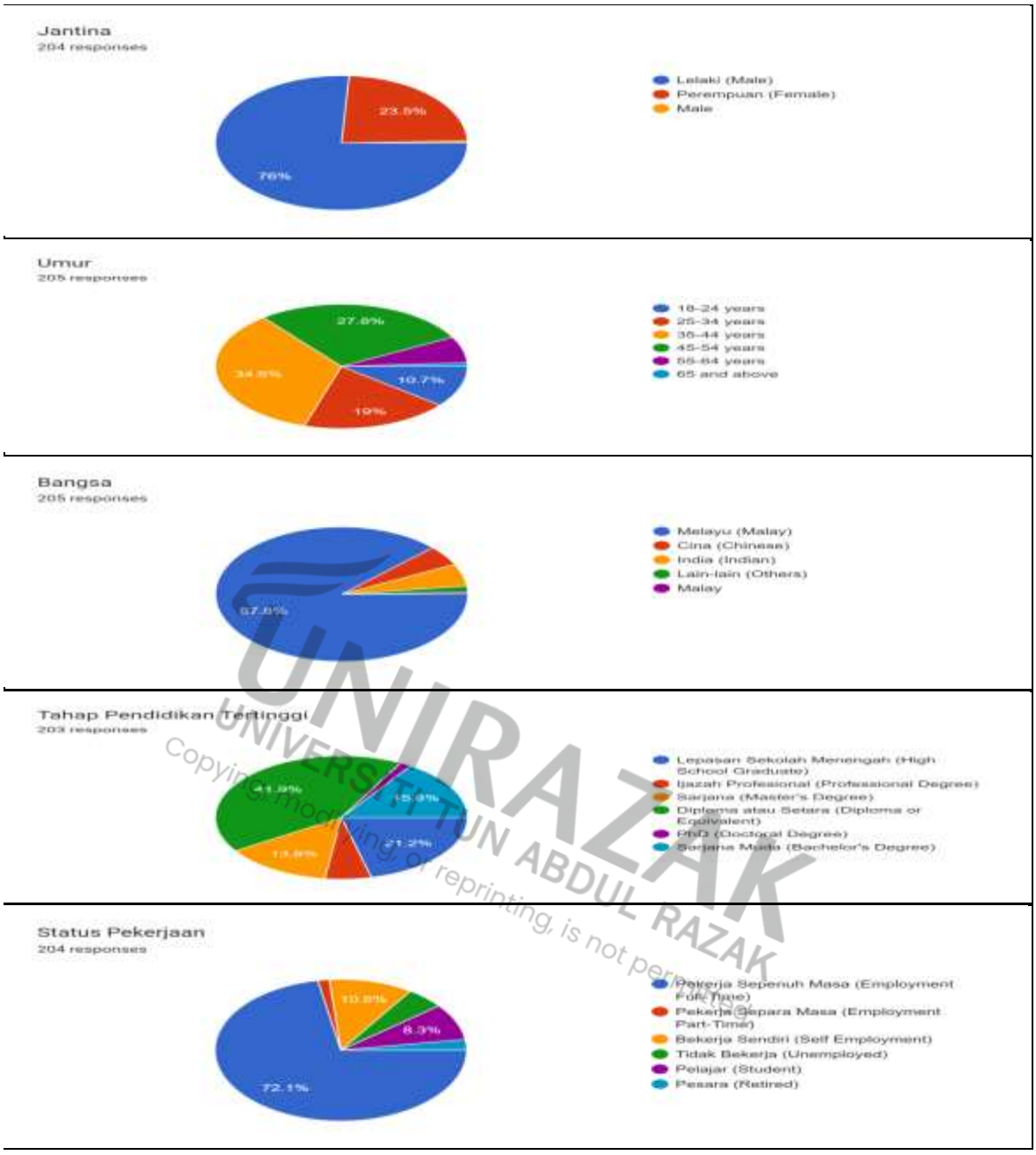


Figure 26. Demographic of Respondents Analysis Chart 1

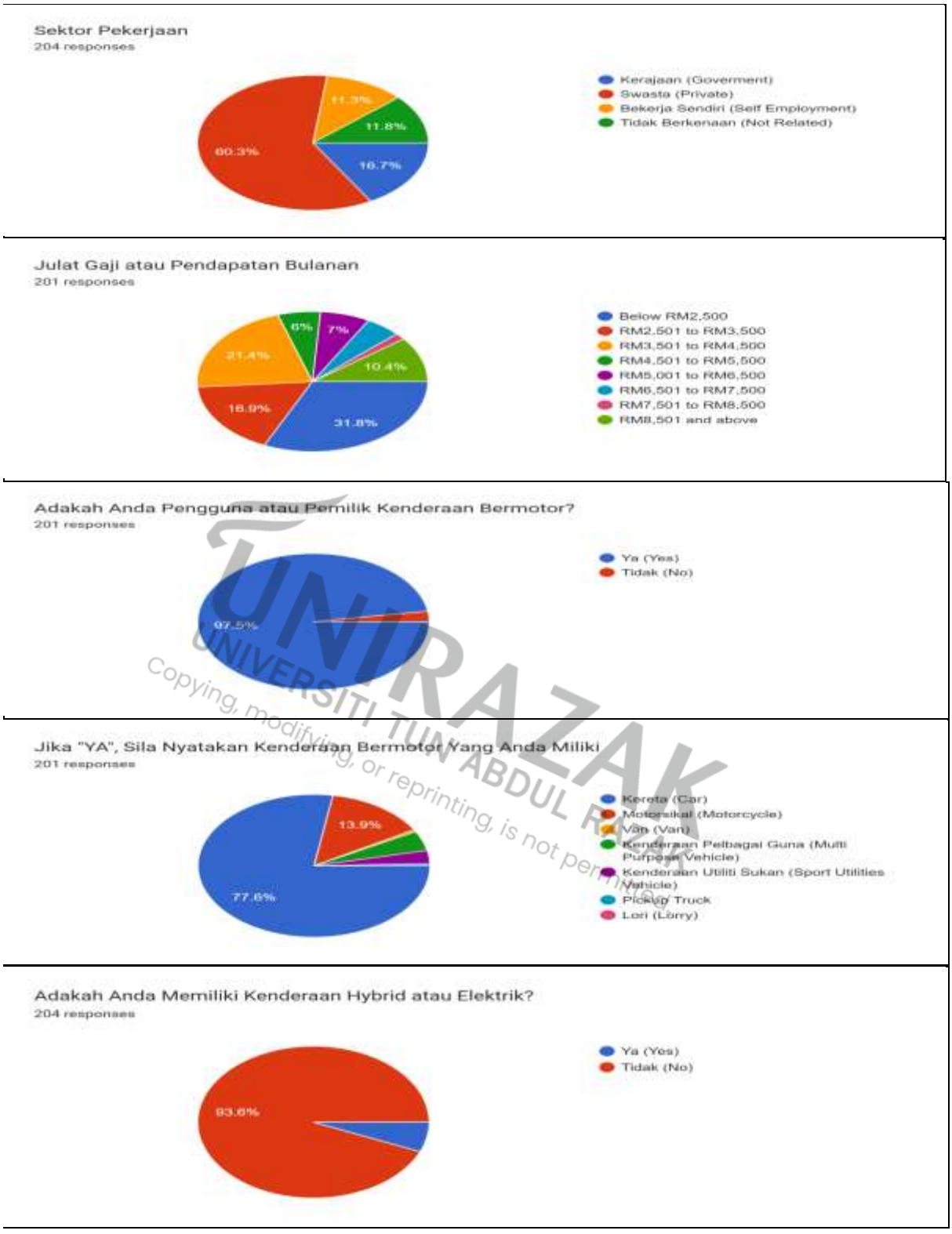


Figure 27. Demographic of Respondents Analysis Chart 2

4.2.2 Level of awareness regarding hybrid and electric vehicles Respondents

For the level of awareness about hybrid and electric vehicles, it is very important to know whether consumers are aware of the existence of hybrid and electric vehicles in the Malaysian market industry. This will determine how many are aware that hybrid and electric vehicles have been in the Malaysian automotive industry for almost 30 years in the 90s. Do customers know that hybrid vehicles have existed in the world since the 1800s. From this survey, almost more than half of the respondents know that the existence of hybrid and electric vehicles has existed since the beginning, but it was not commercialized for certain reasons. From this survey, 58.3% of respondents also found out and 41.7% did not know about the existence of hybrid and electric vehicles since the 1800s. The second question that was asked to the respondents was about the hybrid and electric vehicle market that has been marketed in Malaysia since the 90s and has been produced by renowned vehicle manufacturers from Japan, namely Honda and Toyota.

From the survey conducted, it was found that only 57.6% knew that hybrid and electric vehicles have been in the Malaysian market for almost 30 years and 42.4% knew of their existence since the 90s. The third survey was conducted, have respondents ever seen hybrid and electric vehicles driven on Malaysian roads. From this survey, almost all respondents have seen hybrid and electric vehicles driven on the road, namely 96.1% and 3.9% who have never seen hybrid and electric vehicles driven on the road. The next survey question was whether respondents had ever driven hybrid and electric vehicles, the results obtained were that only 42.6% had ever driven hybrid and electric vehicles while 57.4% had never driven hybrid and electric vehicles. The next survey question is about hybrid and electric vehicle models that respondents know can be found in the Malaysian market, which are 3 main models such as Toyota 45%, Honda 19.8% and Tesla 12.9% while the rest are models such as Nissan, Daihatsu. , Suzuki, Hyundai and Kia. Respondents' knowledge about vehicles that have 2 power sources, i.e. HV battery and engine power, is high at 85.8% while only 14.2% know. While electric vehicles use fully electric power sources are also widely known by the respondents which is a relatively high number which reaches 88.2% while those who do not know only 11.8%.

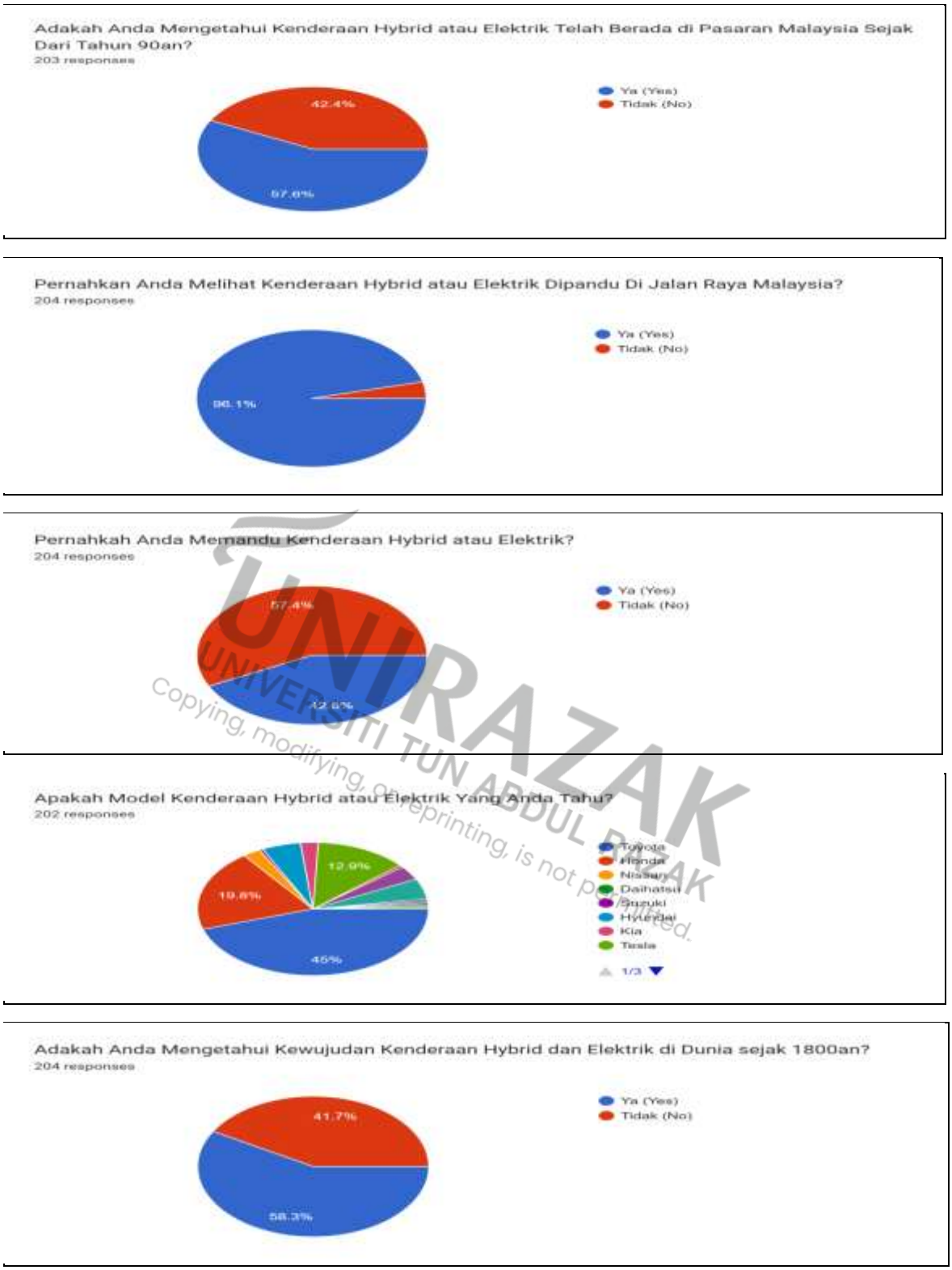


Figure 28. Level of awareness regarding hybrid and electric vehicles Respondents Analysis Chart 1

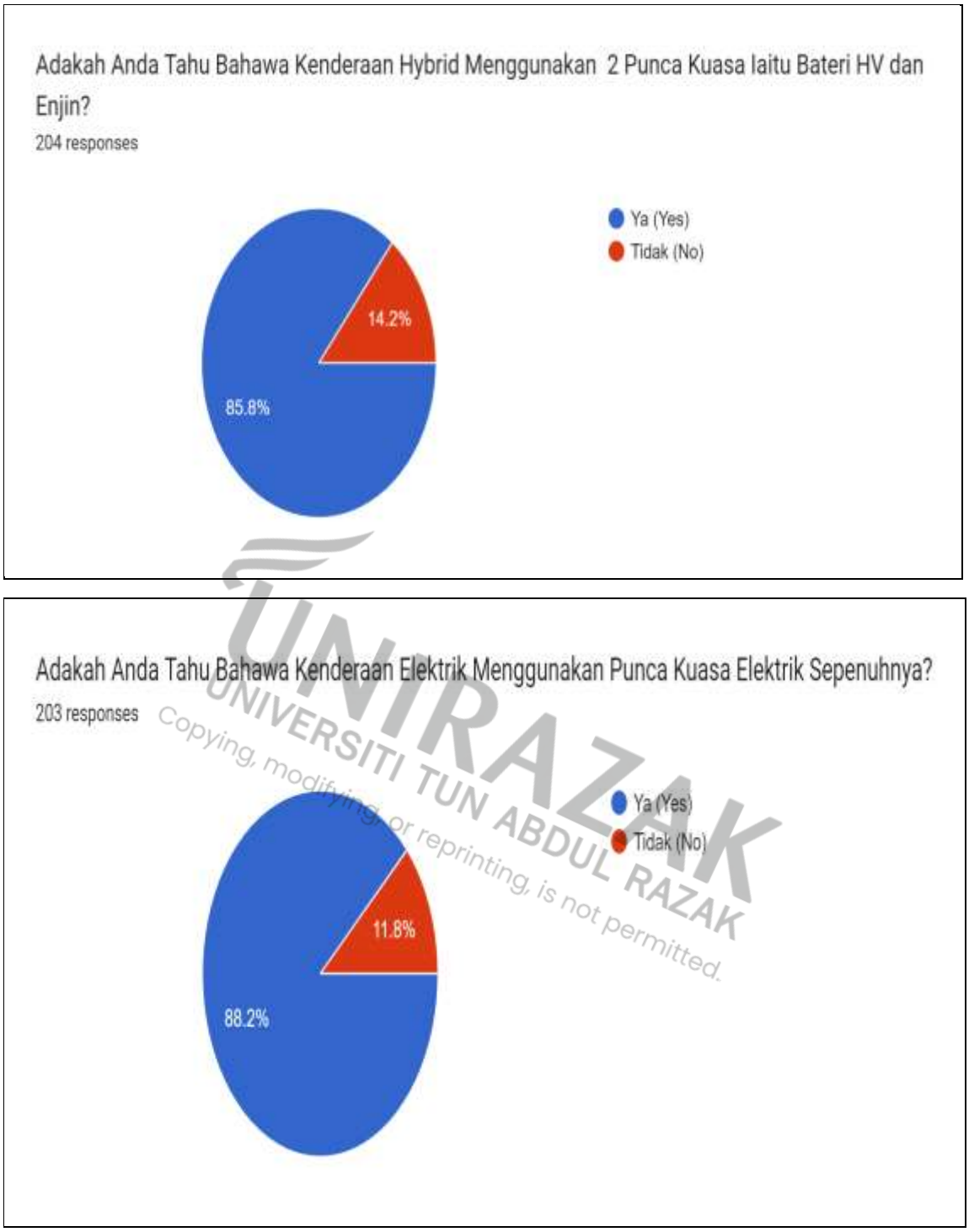


Figure 29. Level of awareness regarding hybrid and electric vehicles Respondents Analysis Chart 2

4.2.3 The price of hybrid and electric vehicles Respondents

The challenge of developing hybrid and electric vehicles in Malaysia is also based on the price factor of hybrid and electric vehicles which are more expensive than conventional vehicles that use regular engines. The factor that contributes to the price of expensive vehicles is because almost all vehicle components are imported from abroad causing the price to be high. From the survey conducted on respondents, it was found that hybrid and electric vehicles are more expensive than vehicles that use conventional engines and respondents who strongly agree are 45.3% that the price of hybrid and electric vehicles are more expensive than normal vehicles and while 25.1% agree that hybrid vehicles and electricity is expensive while the rest think the price is affordable for the high income group. As for the price of road tax and insurance for hybrid and electric vehicles is more expensive than vehicles that use conventional engines and from the survey conducted by the respondents, they think the price of insurance and road tax for hybrid vehicles which are electric fans is in line with the price of the vehicle which is 37.7% while who think the price is more expensive than a normal vehicle is only 18.6%. In terms of fuel consumption, the majority agreed that hybrid and electric vehicles provide optimal fuel savings of 67.6%. From an environmental point of view, 67.6% of respondents agreed that hybrid and electric vehicles can reduce air pollution because the rate of exhaust gas production is relatively low because the rate of engine use is reduced because at certain times the vehicle only uses the engine.

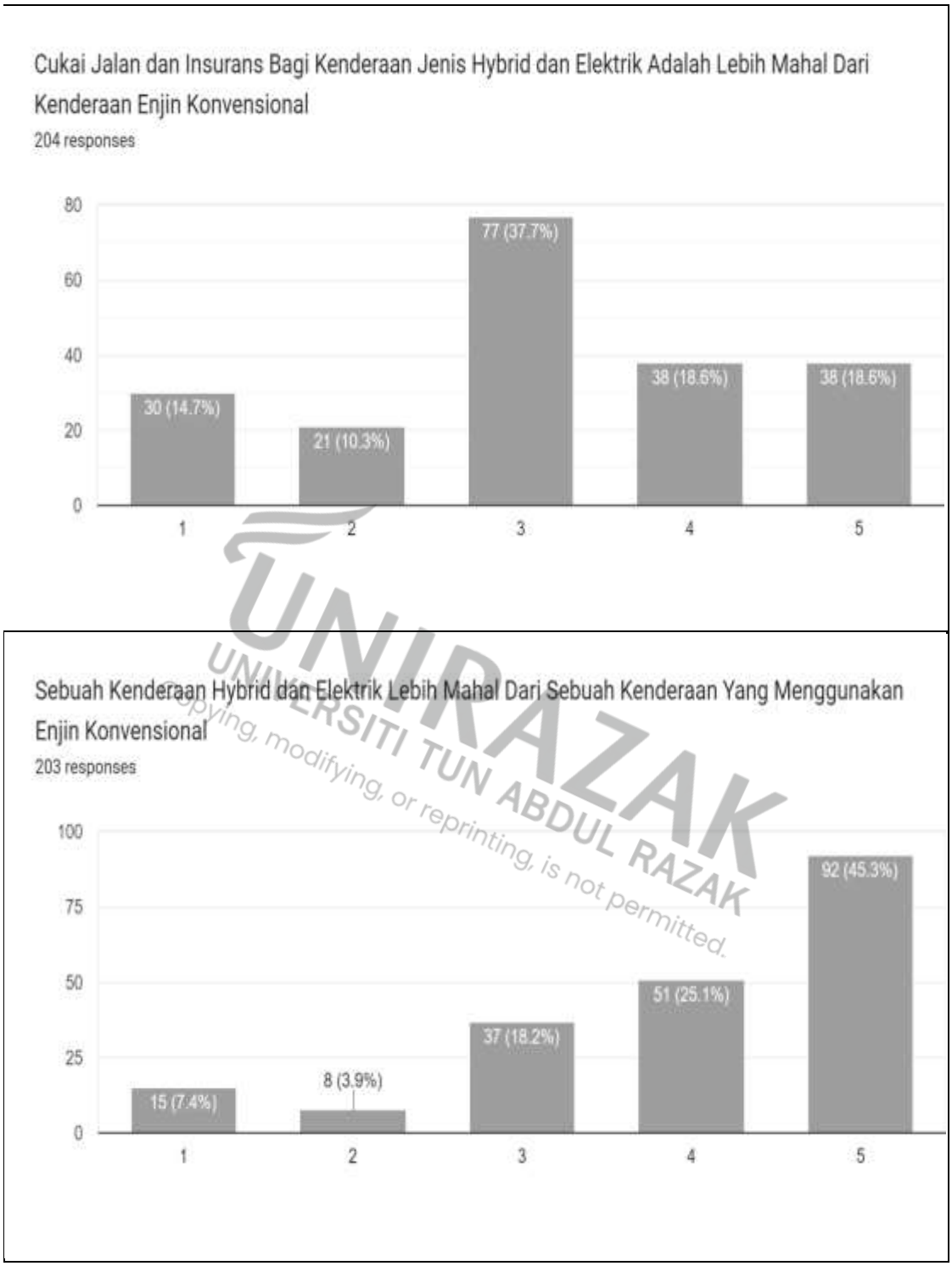


Figure 30. The price of hybrid and electric vehicles Respondents Analysis Chart 1

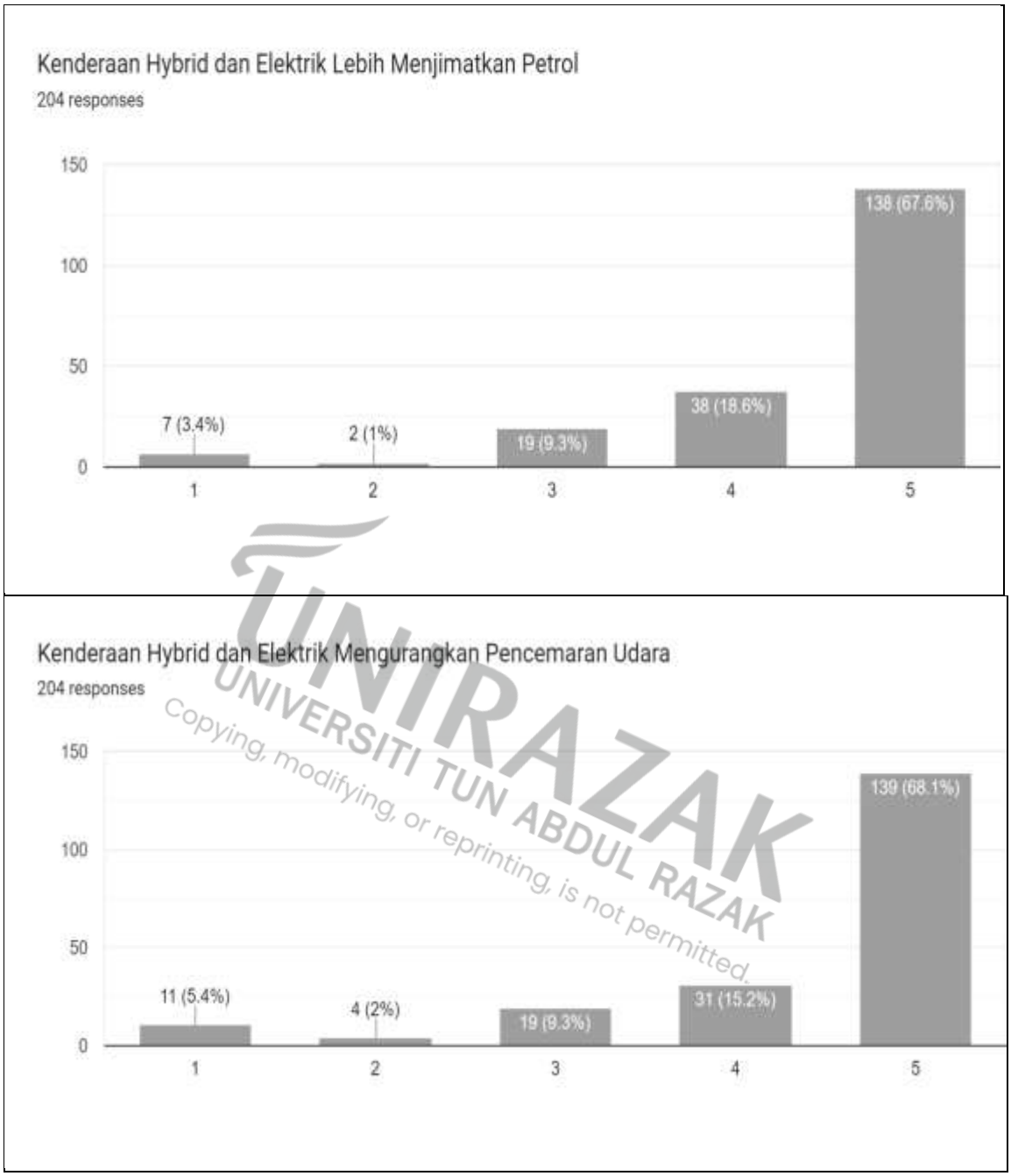


Figure 31. The price of hybrid and electric vehicles Respondents Analysis Chart 2

4.2.4 Spare parts for hybrid and electric vehicles Respondents

Regarding hybrid and electric vehicle spare parts, the survey found that the price of hybrid and electric vehicle spare parts is more expensive than conventional engine vehicles because all hybrid and electric vehicle spare parts are imported from abroad and also the foreign currency exchange factor also causes this to happen. An increase occurred and respondents who strongly agreed were 46.6% and those who agreed were 30.9%. The second factor that causes the price of hybrid and electric vehicle spare parts to be expensive is also due to the difficulty of finding these spare parts either in a parts store or a used parts store. Customers can only get original spare parts at the manufacturer's service center which must be expensive because the spare parts are original. survey of respondents on hard-to-find spare parts found that 30.9% strongly agreed, while 30.4% agreed and 33.3% agreed on this matter.

In addition, most hybrid and electric vehicle spare parts have to be imported from abroad because most hybrid and electric car models are imported from abroad and not developed in Malaysia. This statement was agreed by the respondents with 43.1% strongly agreeing and 25.5% agreeing with this statement. The operation of hybrid and electric vehicle spare parts also needs to be handled by those who are skilled in this field because it involves safety and high cost. This statement is also supported by respondents where 57.8% strongly agree and 26.5% agree while the rest neither agree nor disagree. Another challenge in the development of hybrid and electric vehicles in Malaysia is that workers' wages are more expensive than conventional vehicle technicians. This is because being a hybrid and electric vehicle technician requires expertise and certification to perform service and maintenance. because it is not the same as a conventional vehicle that involves high voltage and is more related to the safety issue of the technician and the vehicle as well. A survey study has been conducted that the price of expensive spare parts and high labor rates are among the factors that make consumers less interested in owning hybrid and electric vehicles. Out of a total of 202 respondents, 34.2% strongly agreed, 28.2% agreed and some disagreed and disagreed because for those with high incomes there is no problem to use hybrid and electric vehicles, only the middle class has a little problem when it comes to expensive repairs is required.

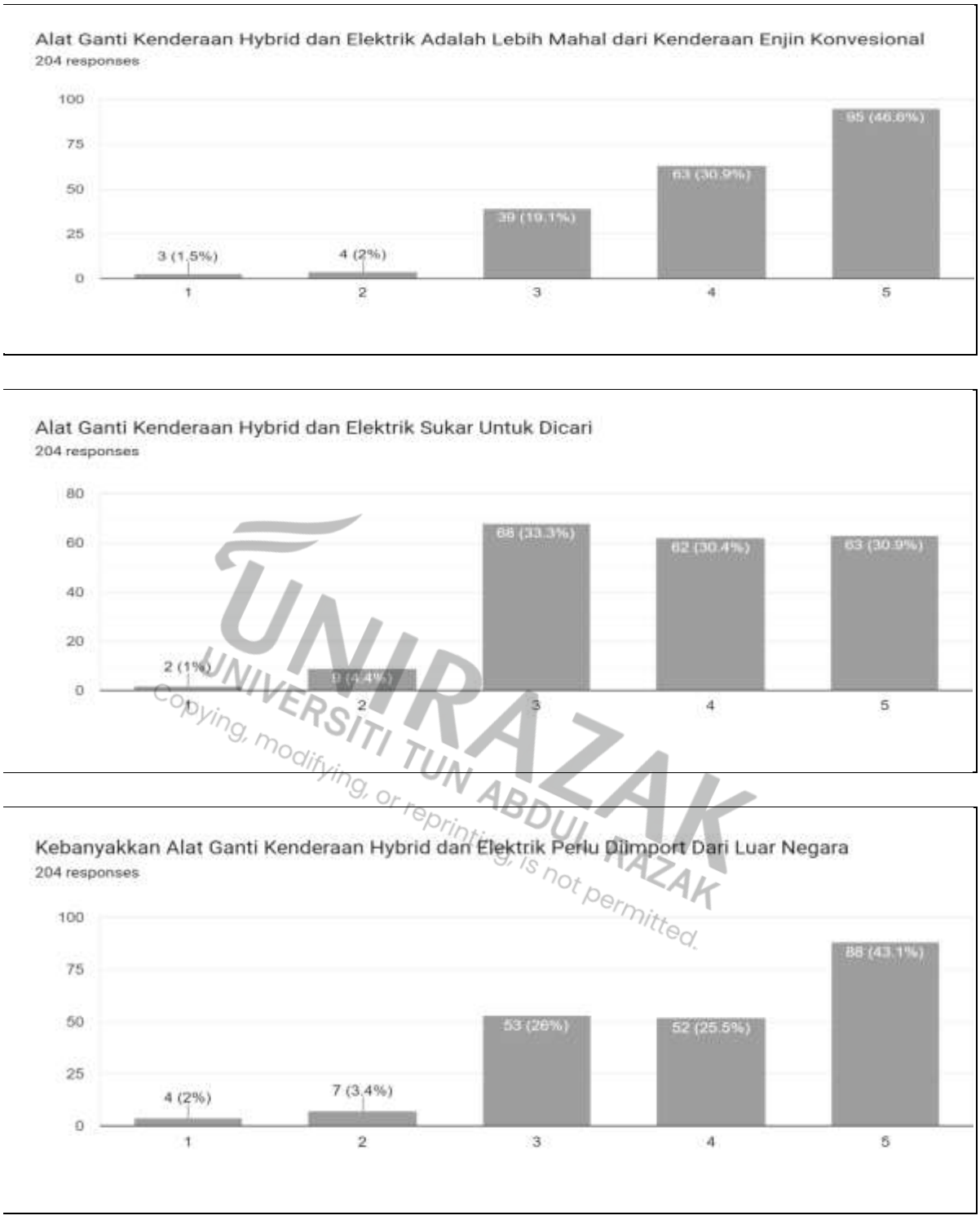
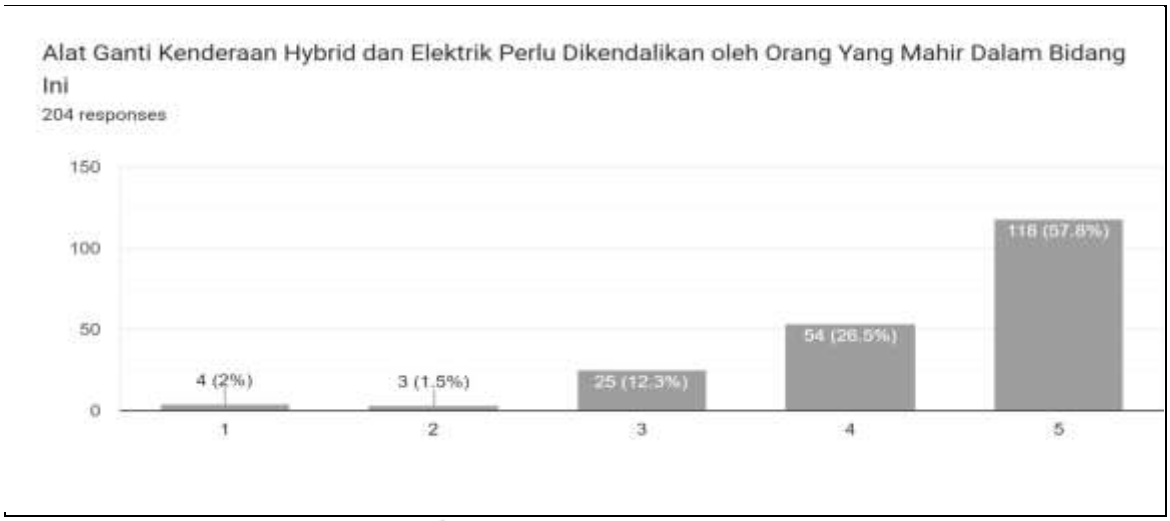


Figure 32. Spare parts for hybrid and electric vehicles Respondents Analysis Chart 1



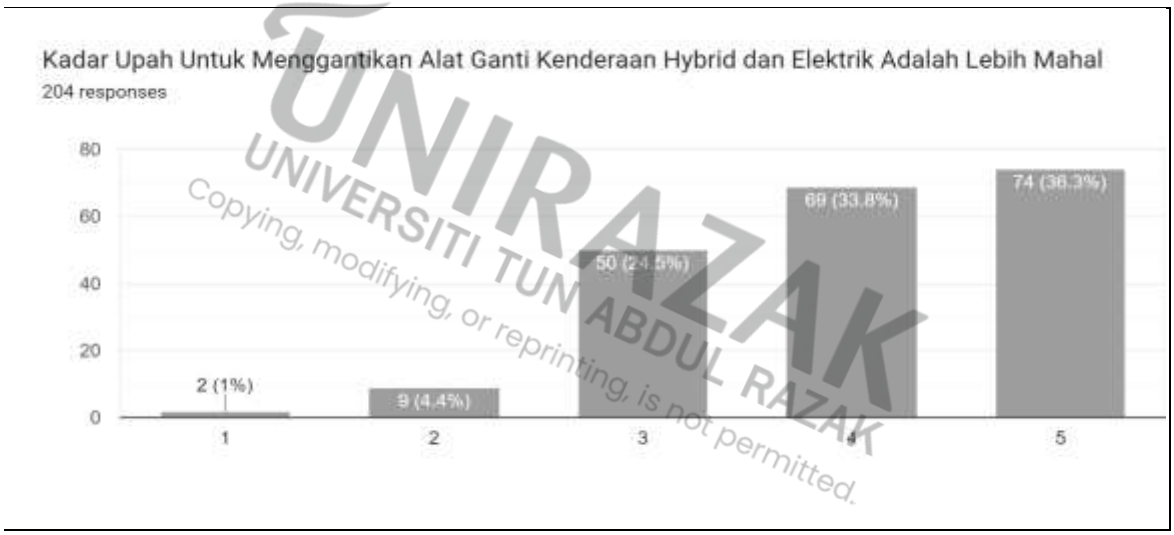


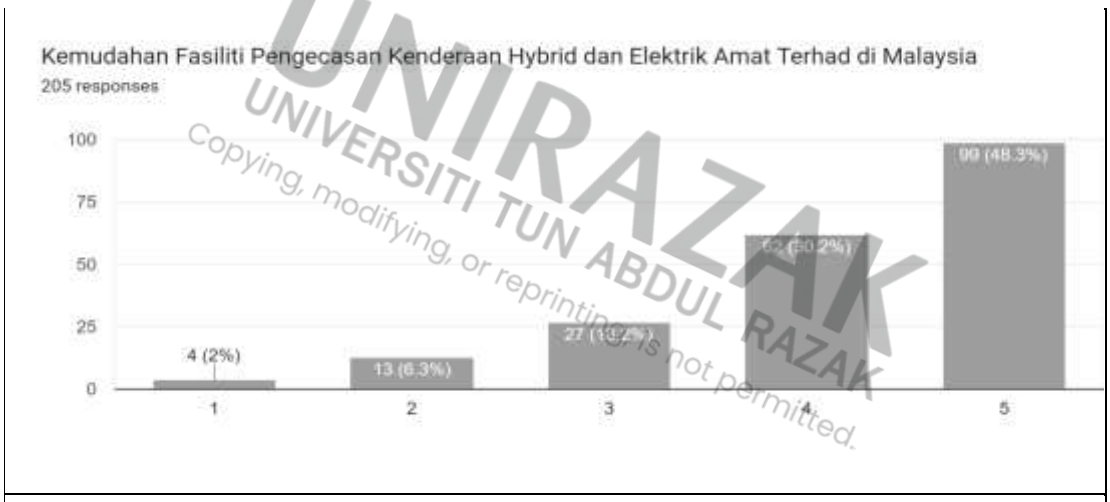
Figure 33. Spare parts for hybrid and electric vehicles Respondents Analysis Chart 2

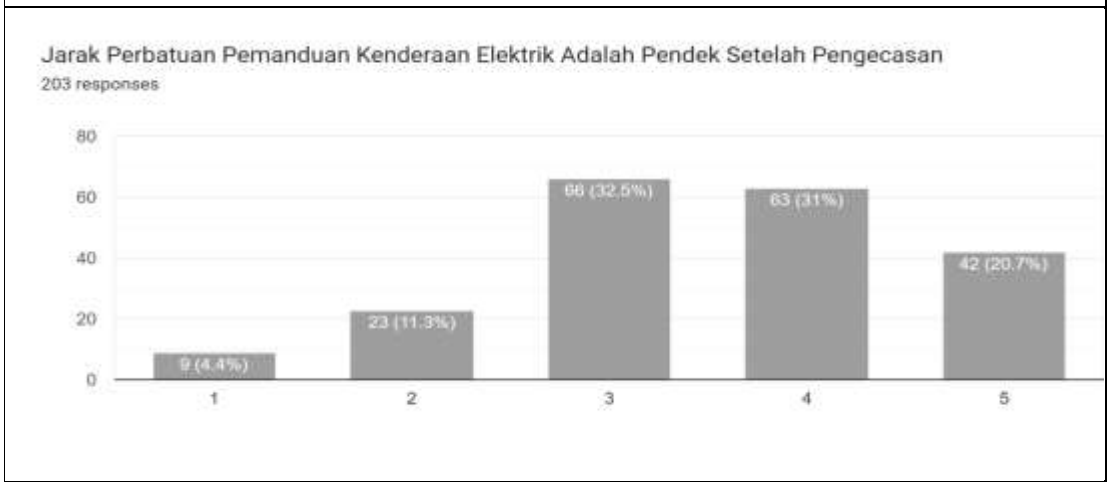
4.2.5 Electric vehicle charging facilities Respondents

Regarding the facility of charging electric vehicles and electricity is very lacking in Malaysia nowadays which causes users to worry about using electric vehicles for long distance driving due to the relatively insufficient number of charging points.Currently according to sources from the Ministry of International Trade and Industry Malaysia (MI) through Senior Director Datuk Hanafi Sakri, the total number of charging facilities in Malaysia currently has approximately 900 EV charging stations, as reported by Edgeprop. Compared to its nearest neighbor, Singapore, which now has nearly 3,600 charging stations to support its smaller population and size.A survey conducted on respondents as much as 48.3% strongly agree regarding the facilities that are not yet certain in our country and 30.2% agree while According to 13.2% except and mostly less agree and disagree. Regarding the relatively short driving distance also invites many opinions of all the respondents, that is, those who strongly agree are only 20.7% and those who agree are 31%, while those who are neutral are as much as 32.5%. The number of those who disagree and disagree are only 11.3% and 4.4% respectively. Regarding charging facilities, they are only available in big cities. got a good reaction from all the respondents which is as much as 46.1% who strongly agree and 33.8% who agree and 15.2% are neutral while 2.9% and 2% less agree and

disagree. Regarding charging facilities that are not available in small towns and remote areas that find almost 53.4% and 26.5% while 15.7% were neutral. For those who disagreed and disagreed, 2.5% and 2% of the results were found.Regarding the factor of the charging period, those who think it takes a long time to get enough energy and the response they get from the respondents. The results from the respondents found 49.8% and 21.7% while those who are neutral are also 21.7% and the rest are less agree.

Regarding the refueling period is faster than the charging period and after the study was done it was found that 69% of respondents strongly agreed with this statement while 15.8% agreed and 11.3% disagreed. The remaining 4% of respondents disagreed. Factors of limited facilities is what causes consumers in Malaysia to be less interested in using electric vehicles at this time and the response from the survey found that 50% strongly agreed and 23.5% agreed while 19.1% were neutral. Respondents who did not agree were as much as 7.4%.





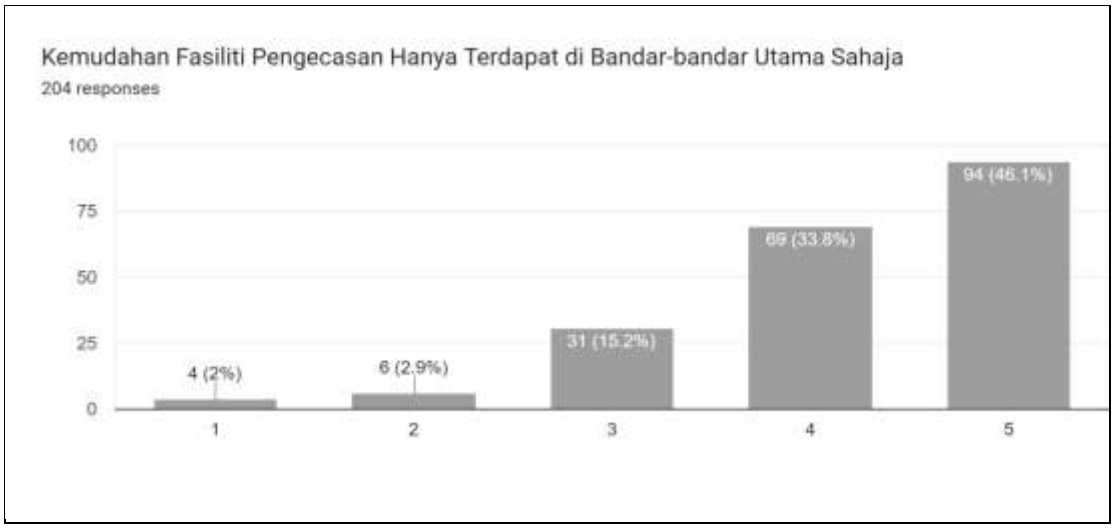
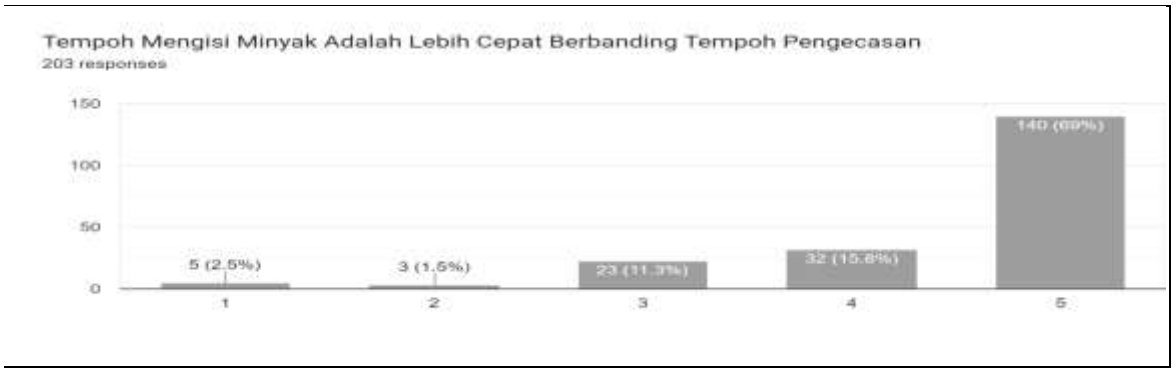


Figure 34. Electric vehicle charging facilities Respondents Analysis Chart 1



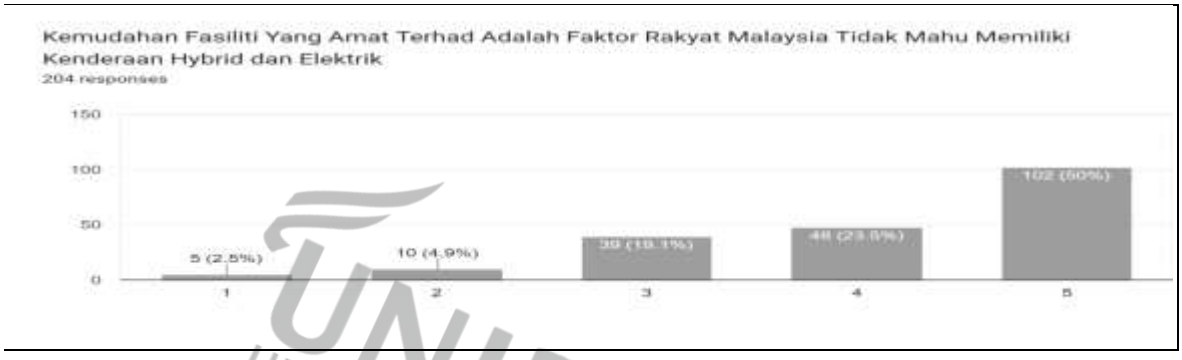


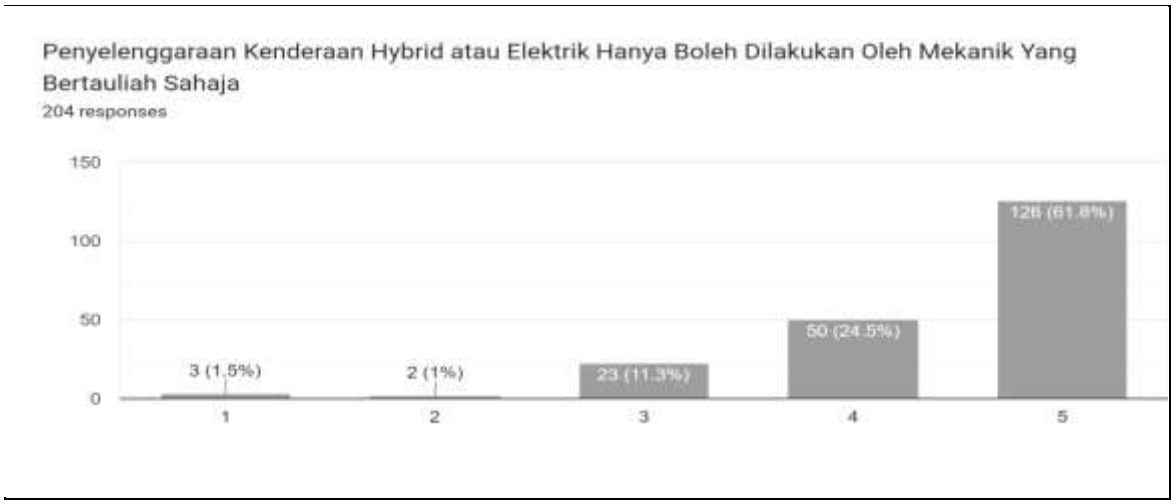
Figure 35. Electric vehicle charging facilities Respondents Analysis Chart 2

4.2.6 Service and maintenance Respondents

Another issue raised is after-sales service which involves the service and maintenance of hybrid and electric vehicles. The average motor vehicle user thinks that the service and maintenance of hybrid and electric vehicles is complicated and expensive. Furthermore, there are not many private workshops. who are brave and have skills regarding hybrid and electric vehicles because it involves the safety of the technicians who perform the maintenance of the vehicles involved which use high voltage currents which can cause death in the event of a shock to the technicians involved. From the survey conducted regarding maintenance can only be done by certified technicians and the response from the respondents is 61.8% strongly agree and 24.5% agree, while 11% are neutral and only 2.5% disagree. One of them. issues related to competent certified technicians in the field of

hybrid and electric vehicle maintenance are also suggested to users to get views and opinions. From the results of the survey it was found that 61.6% of respondents strongly agreed and 26.1% agreed while 10.3% were neutral and only 2% were less and disagreed on this matter. The proposed question is that non-certified mechanics cannot service and maintain hybrid and electric vehicles because it involves safety issues because hybrid and electric vehicles use high voltage in the vehicle system and require certification to do so to carry out repair work on these vehicles. One of the issues faced by users is that the number of certified workshops in carrying out the maintenance of hybrid and electric vehicles is very limited in Malaysia. The survey conducted also found that 46.1% of respondents strongly agree and those who are 37.3% while those who are neutral are only 14.2%. For respondents who do not agree, it is only 2.5%.

Regarding the issue of high maintenance wages for vehicles and electric vehicles as an obstacle to the development of the country's automotive industry. There is no doubt that this salary rate issue occurs because not many technicians are certified for the service and maintenance process of hybrid and electric vehicles because they require special training to operate these vehicles because it involves safety issues when operating high current voltage. When it comes to safety issues, it should not be taken lightly because when something goes wrong, it can involve the loss of life to the technicians handling the maintenance of hybrid and electric vehicles. From the survey conducted, respondents who strongly agree are 38.7% and those who agree are 36.8% while those who are neutral are only 21.6%. Only 3% who disagree with this may be from rich and high income group so there is no problem about high maintenance cost. The last survey question is the issue of the number of hybrid and electric vehicle workshops and technicians and the high salary rate is also among the factors Malaysians choose not to own hybrid and electric vehicles. From the survey that found 41.4% strongly agreed with this statement and 29.1% agreed while 22.2% were negative towards this statement. Only 7.4% disagreed with this statement.



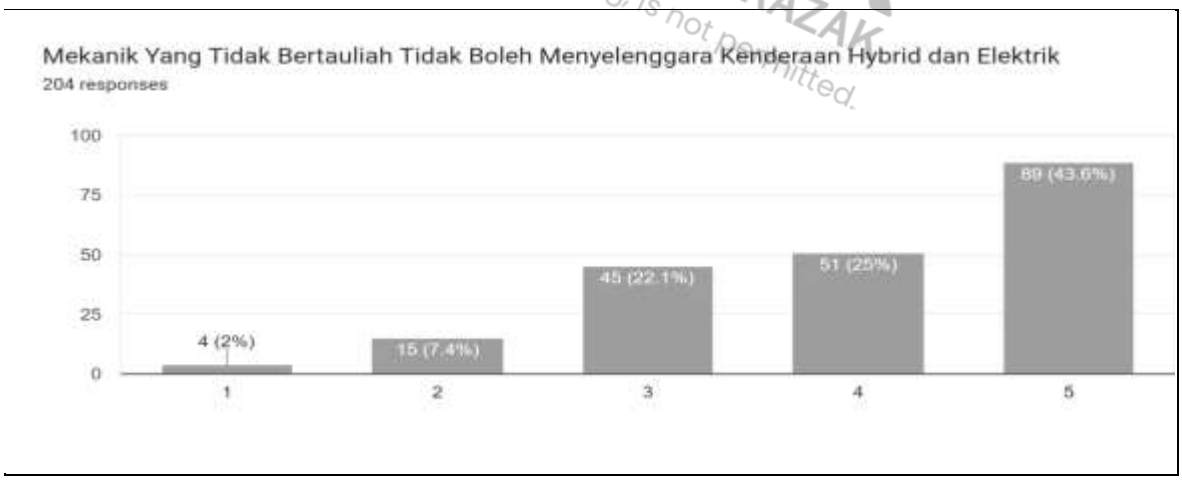
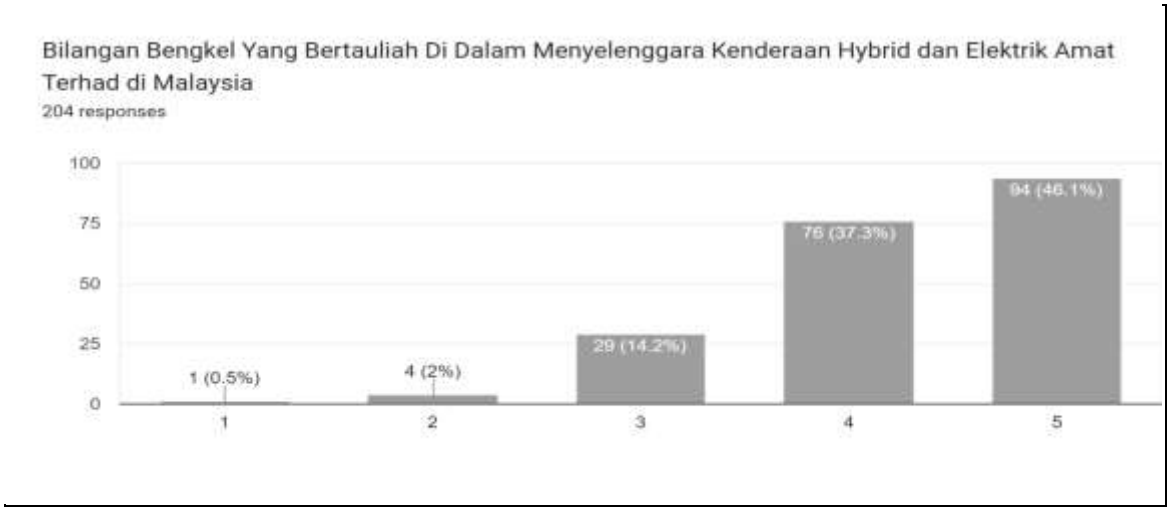
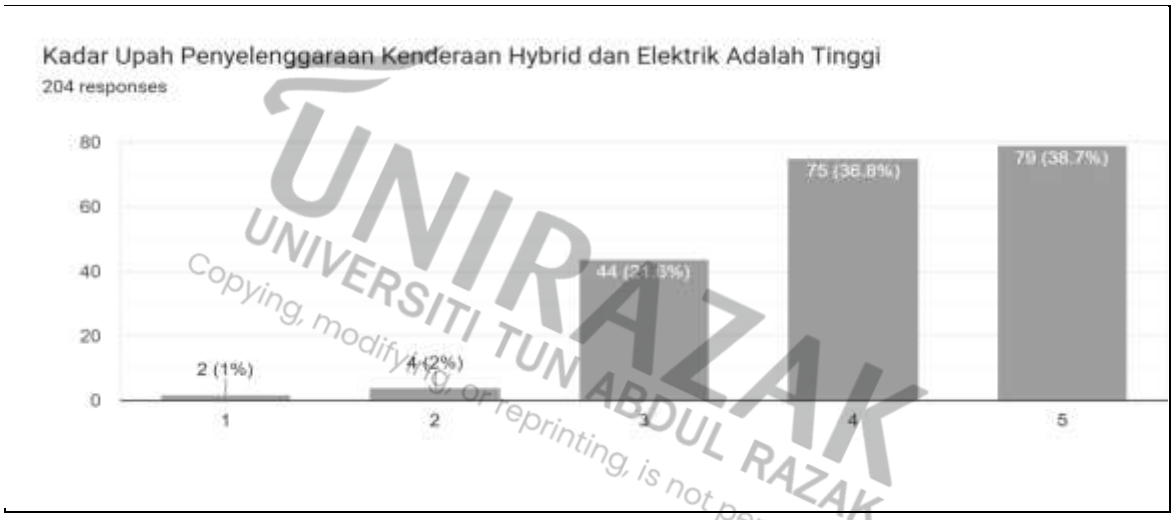


Figure 36. Service and maintenance Respondents Analysis Chart 1





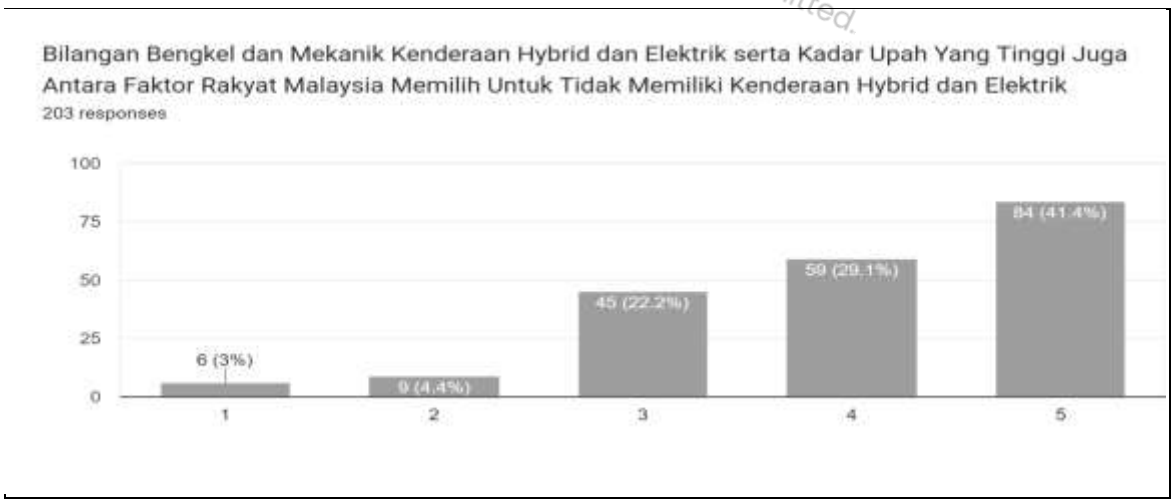


Figure 37. Service and maintenance Respondents Analysis Chart 2

4.3 Discussion of Results

From the results of a survey conducted on more than 200 respondents regarding the issue of Hybrid and Electric Vehicle Industry Challenges in the Malaysian Automotive Market in the next 5 years. This survey also covers various levels of the consumer community to obtain the results of the challenges that will be faced in the next 5 years according to the survey and the factors that exist in Malaysia. According to the survey, almost all respondents are motor vehicle users and the majority use cars. Out of a total of 77.6% of motor vehicle users, only 6.4% currently use hybrid and electric vehicles. This is a low figure which is also a big challenge for the country's automotive industry, especially for manufacturers and distributors of hybrid and electric vehicles. In terms of consumer awareness, the level of awareness of hybrid and electric vehicles in the Malaysian market has been low since the 1990s. Again and from the answers to the survey conducted only 57.6% of respondents know about the existence of hybrid and electric vehicles in Malaysia. This may be due to the lack of marketing activities by vehicle manufacturers and may also be that consumers do not want to know because they are comfortable with the conventional vehicles that are used now. As for the results of the study that consumers see hybrid and electric vehicles driven on Malaysian roads is high which is 96.1% this may be because since 2020 many national automotive industry players are promoting and releasing new vehicle models that use hybrid and electric. . With this atmosphere happening, it indirectly attracts people to know the advantages and advantages of hybrid and electric vehicles. In recent times, many automotive companies also hold road shows and offer test drives of hybrid and electric vehicles. Electricity to users and indirectly give users the opportunity to try and feel the experience of driving hybrid and electric vehicles. The results of the survey also found that only 42.6% have experience driving hybrid and electric vehicles and this result is relatively low because the opportunity for a test drive is relatively less and limited.

Of the models that Malaysia currently markets, it consists of the brands Toyota, Honda, Nissan, Daihatsu, Suzuki, Hyundai, Kia and Tesla, almost 45% of consumers know the Toyota brand using hybrid and electric vehicles while the Honda brand is 19.8% and the third is the Tesla brand 12.9%. From the results of this survey, consumers are already

aware of hybrid and electric vehicles but not completely because there may be no problem with the use of vehicles that use gasoline and diesel fuel now. The factor of ease of getting oil in Malaysia too and at a reasonable price compared to neighboring countries means that there is no strong pressure to completely change from vehicles that use conventional engines to vehicles that use hybrids and electricity. From a technical point of view, from the results of the survey conducted, most users know that hybrid vehicles use 2 power sources, namely engine power and high voltage battery power because the survey results reached 85.8% and also users know that electric vehicles use a high voltage battery power source entirely to move the vehicle and the survey results reached 88.2%. If according to the percentage from a technical point of view, users should know the power source used by these hybrid and electric vehicles.

One of the issues regarding hybrid and electric vehicles is that many consumers think that the price of hybrid and electric vehicles is very expensive and unaffordable. From the research conducted, 45.3% of consumers said that the price of hybrid and electric vehicles is higher than vehicles using conventional engines, while 25.1% also agreed with this statement and 18.2% disagreed. Only 11.3% less and disagree with this statement. Some also argue that road tax and insurance for hybrid and electric vehicles are more expensive than vehicles using conventional engines. From the results of the survey it was found that 37.7% were neutral, while 18.6% strongly agreed and 18.6% also agreed. The remaining 25% of respondents are less and do not agree with this statement. This factor also depends on the value of the vehicle involved to determine the amount of insurance and road tax that users have to pay because there are also those who use conventional vehicles who usually end up having to pay expensive insurance and road tax because of the price tall paper and use tall cc. The study also shows that hybrid and electric vehicles use more petrol because from the results of the questionnaire, there is a high response which is 67.6% strongly agree and 18.6% agree. The exception is 9.3% and less and no. only 4.4% agreed. When it comes to hybrid and electric vehicles to reduce air pollution, the results of respondents who agree are 68.1% and those who agree are 15.2%. Neutral respondents were 9.3%, probably because they were not sure or did not know. While 7.4% of respondents were less and did not agree with this statement for uncertain reasons.

Regarding spare parts for hybrid and electric vehicles which are more expensive and hard to find spare parts, there are many respondents who gave a positive response who strongly agree and agree with this statement because for now Malaysia has to import from overseas producing countries for new and used. spare parts for these hybrid and electric vehicles because Malaysia does not yet have the expertise to produce these hybrid and electric vehicle components. The foreign currency exchange factor is also the main cause of spare parts prices becoming more expensive as well as other operating costs such as logistics, taxes and so on. From the survey conducted, it was found that respondents agree and strongly agree with the statement that hybrid and electric vehicle spare parts are more expensive for vehicles that use conventional engines by 77.5% while hybrid and electric vehicle spare parts are difficult. to find also received feedback from respondents who agreed and strongly agreed by 61.3%. While 68.6% of respondents are concerned about hybrid and electric vehicle spare parts that need to be imported from abroad and only 26% of them are neutral.

In addition to the factor of expensive spare parts for these hybrid and electric vehicles, the issue of expensive repair costs and labor wages also got reactions from respondents because the cost of inspection and vehicle repair wages are more expensive because there are not many workshops that can do repair work. This hybrid vehicle is due to the fact that only certified technicians can do the maintenance work on this hybrid and electric vehicle because it involves safety issues due to the use of high-powered electric current. Technicians also need to take a special course to operate these hybrid and electric vehicles and also need to pass a set test before being commissioned as a certified technician to service and repair hybrid and electric vehicles. Most users must take their vehicles to the manufacturer's service center to be serviced and maintained, especially vehicles that are still under warranty and as you know, the service center actually uses a standard labor rate for each job done, which is a wage rate according to the hourly work rate that will cause wage rates become expensive. Most of the workshops outside do not dare to do hybrid and electric vehicle repair work because there is no experience and no special equipment suitable to carry out this repair and maintenance. This is also one of the factors for motor vehicle users to enter Malaysia are less interested in owning hybrid and electric vehicles and from the research that was conducted it was found that 57% of respondents strongly

agreed and 26.5% agreed that hybrid and electric vehicle parts should be handled by skilled personnel. Although the rate of maintenance of hybrid and electric vehicles is expensive, there is a reaction from the respondents which is 36.3% strongly agree and 33% agree. For respondents who said this factor made consumers less interested in owning hybrid and electric vehicles, 34.2% strongly agreed and those who agreed were 28.2%. While neutral is 25.2% regarding this matter.

One of the important factors for the development of hybrid and electric vehicles in Malaysia is the charging facility for fully electric models and PHEV hybrid models. According to the latest data, there are only nearly 900 units of charging facilities across the country, most of which are located at rest and treatment stops on major highways and also at prominent sharing centers. The factor of few comparable models with limited mileage also presents a challenge in the development process of the Hybrid and EV industry. Most of these charging facilities are only available in big cities such as the Klang Valley, Penang and Johor Bahru. For small towns there is still no charging facility because there are not many users. The current charging facility takes quite a long time which is a minimum of 1 hour and above to get a sufficient level of charging of the HV battery before the vehicle can move. .Respondents also compared the duration of refueling such as petro and diesel faster than the detection period of HV batteries. From the results of the survey, the respondents found that facilities are limited which is 48.3% strongly agree and 30.2% agree. Regarding the less driving distance after the detector is also a factor but got various opinions from the respondents namely 20.7% strongly agree, 31% agree and 32.5% are neutral. On the issue of facilities that are only available in big cities, we also found many respondents who strongly agreed, 46.1% and those who agreed were 33.8%. Regarding the facilities in small towns, there was a reaction from the respondents that 53.4% strongly agreed and 26.5% agreed. The charge period issue received feedback from respondents that 49.8% strongly agreed and 21.7% agreed quickly compared to the detection period, respondents gave a response of 69% strongly agree and 15.8% agree. While 11.3% are neutral. The very limited ease of use will also cause motor vehicle users in Malaysia to not want to use hybrid and electric vehicles, with 69% strongly agreeing and 15.8% agreeing. While 11.3% disagree. One of the most important factors also involves the service and maintenance of hybrid and electric vehicles because it is necessary to involve qualified

skilled personnel to handle repairs because it involves.One of the most important factors also involves the service and maintenance of hybrid and electric vehicles because it is necessary to involve qualified skilled personnel to handle repairs because it involves the safety of the workers involved and other members as well. The requirement of a certified technician is also necessary because to avoid damage to other components if the repair process does not follow the correct method or method according to the manual workshop reference guide issued by the vehicle manufacturer. From the survey conducted, the respondents who strongly agree are 61.8% and those who agree are 24.5, while the neutral is only 11.3%. For Competent staff, respondents who agree are 61.6% and those who agree are 26.1%, while those who are neutral are only 10.3%. Respondents also strongly agreed that non-certified technicians should not maintain hybrid and electric vehicles to prevent any unwanted things from happening which was 43.6% and 25 who agreed, while only 22.1% were neutral. A fairly significant problem at the moment is that the number of workshops and service centers that maintain hybrid and electric vehicles is very less which will make it difficult for users to do maintenance later and the respondents who strongly agree are 46.1% and those who agree are 37.3%, while those who are neutral are 14.2%. In addition, the wage rate is also high and this statement is agreed by the respondents, namely those who strongly agree are 38.7% and those who agree are 36.8%, while those who are neutral are 21.6% of the factors above. such as the number of workshops and the number of certified technicians is very less in addition to the very high salary rate compared to vehicles that use conventional engines which will be the reason why consumers are less interested in owning hybrid and electric vehicles. % strongly agree and 29.1% agree, while 22.2% are neutral on this matter.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

From the results of a survey conducted on more than 200 responses, it can be concluded that motor vehicle users in Malaysia are still hesitant to use hybrid and electric vehicles in the next 5 years. Challenges that need to be faced from various angles, from the awareness of motor vehicle users, the price difference what is significant is that hybrid and electric vehicles are still expensive compared to vehicles that use conventional engines. In addition, insurance and road tax prices for hybrid and electric vehicles are also quite expensive compared to normal vehicles. This is because the price of hybrid and electric vehicles is more expensive than vehicles that use conventional engines. In terms of hybrid and electric vehicle spare parts, it is also a challenge in the development process to encourage users to switch to hybrid and electric vehicles because currently the price of spare parts is still expensive compared to conventional vehicles because all components and spare parts have to be imported from abroad involve high costs. In addition, hybrid and electric vehicle spare parts are also difficult to find in the foreign market as well as used spare parts because the available spare parts are very limited compared to current needs and demands. If this happens, the user is forced to buy from the original manufacturer, which is of course 100% pure, but the selling price is very, very expensive. In addition, the wage rate for the maintenance and replacement of hybrid and electric vehicles is also more expensive than normal conventional vehicles because it requires a certified service center or workshop and also skilled and certified technicians in the repair of these hybrid and electric vehicles because it involves safety issues while operating a high electric current. Another factor that also affects users for hybrid and electric vehicles is the after-sales facilities such as charging facilities for electric vehicles and Hybrid PHEVs because for now the available facilities are very limited compared to the vehicles currently on Malaysian roads. In addition, charging period takes a long time to charge an electric vehicle. This also has a negative impact on consumers as after-sales facilities are important for customer comfort. This is a common issue that motor vehicle users have to face, which is to carry out maintenance

services to ensure that the vehicle they drive is always in good condition and always less to drive on the road. The current issue is that the number of service centers and certified workshops that can service and maintain these Hybrid and electric vehicles is very less. The customer's choice is only to go to the manufacturer's service center or an authorized service representative to get the necessary service. If this happens, the customer will have to pay a high cost to cover the cost of parts and work done because the workers who do this repair work are skilled and certified in this field and also the wage rate is according to the standard set by the manufacturer.

The conclusion we can make about the challenges that need to be faced is in the manufacturing industry and after sales and consumers. Obstacles to developing an EV ecosystem in Malaysia include high costs and insufficient supporting infrastructure, including a lack of components, lack of EV experts. and skills, electric grid challenges, increasing demand for lithium-ion batteries and the lack of EV charging standards. The Malaysian automotive industry plays an important role. Important role in the country's manufacturing sector, employing more than 710,000 people and contributing four percent to the country's GDP. Although the electric vehicle (EV) industry is in its early stages of development, it is well-positioned for expansion. Many companies that provide inputs for EV production, such as semiconductors and copper wire manufacturing, already have facilities in Malaysia. However, Malaysia's existing EV infrastructure is still lacking, especially the lack of EV charging stations. Currently, Malaysia only has less than 1000 EV charging stations, which is not enough to meet the vast EV market. Obstacles to developing the EV ecosystem in Malaysia include high costs and insufficient supporting infrastructure, including component shortages, lack of EV experts and skills, electricity grid challenges, increasing demand for lithium-ion batteries and lack of EV charging standards. Although Malaysia is an upper-middle-income country, and EV owners can also claim tax breaks for owning one of these vehicles, EVs remain expensive for most people. Recognizing the gap and need for infrastructure development, the Malaysian Government has pledged to build 10,000 EV charging stations by 2025 in collaboration with the private sector, according to the Low Carbon Mobility Action Plan 2021-2030. Companies that contribute to building EV infrastructure in Malaysia will benefit from government incentives, such as tax breaks. The government expects incentives to attract more EV

manufacturers to establish a presence in the country and contribute to Malaysia's development as an EV manufacturing hub.

Purchase Cost

The biggest challenge of the Electric Vehicle industry is about the cost of purchasing a vehicle because it is more expensive than a conventional conventional vehicle. Electric vehicles are more expensive to build than gasoline-powered ones, mainly because of battery technology. EV batteries must have a large charge to provide the minimum range for most owners, which require a lot of expensive raw materials to manufacture.

Anxiety Reach

Long distance anxiety is real. But people worry about how far they can travel with an EV before finding a charging station and then having to wait through a long charging session. Most EVs on the market achieve a driving distance of between 100-200 kilometers on a single charge. But for long days of travel, weekends, holidays and public holidays EV owners may need time to charge every 3-4 hours.

Figure 38. EV & PHEV Charging Station

Limited Choice

Options for hybrid and electric vehicles are limited compared to gasoline-powered cars, and most car manufacturers offer only a few models. Sedans, hatchbacks and SUVs are increasingly available. However, people looking for a truck or minivan still need more options.

Difficulty Finding Technicians

Car owners find that having their vehicle serviced by a dealer can be more expensive than using a qualified independent maintenance and repair shop. With the EV industry still small in Malaysia, there are not many certified and qualified hybrid and electric vehicle repair technicians.

Figure 39. Skill workers for Hybrid and Electric Vehicle Technician

Charging Infrastructure

The lack of charging stations in many areas of the country increases the incidence of distance anxiety. The federal government is working to overcome and create additional charging infrastructure for PHEV vehicles and Electric cars. Since it was announced last October during Budget 2022 that electric vehicles (EVs) will be fully exempted from import duty and excise from January 1 this year, there has been a steady influx of EVs into the country. With these incentives set to run until December 31, 2023 for fully imported (CBU) EVs and December 31, 2025 for locally assembled (CKD) EVs, things should move at a faster pace next year. The amount of public charging infrastructure is still too little based on the increase in the number of electric vehicles that are already on Malaysian roads and with less than 1000 units of public charging points can be considered still low and

insufficient to meet the needs of consumers especially. on weekends. and public holidays including on festival days. This year's target is the installation of 5,000 EV charging station infrastructure nationwide According to the deputy minister of science, technology and innovation (MOSTI), Datuk Ahmad Amzad Hashim.

Figure 40. Example Electric Vehicle Charging Station Fasility

Charging Speed

Charging an electric car can be a problem for drivers who have trouble adjusting to the EV lifestyle, which can dictate a slower pace of life.

There are currently three main levels of EV chargers:

Level 1: Uses a standard 120V plug and can charge most vehicles overnight. Larger batteries can take 20 hours or more to fully charge. Most residential chargers are Level 1.

Level 2: Using a 240V plug and SAEJ1772 connector. Most public charging stations are Level 2 or a combination of Level 2 and Level 3.

Level 3: Uses a 480V direct current (DC) fast charger to provide the fastest charging possible.

A level 2 charger provides a full charge in 3-4 hours (or as much as 10-12 hours, depending on battery size). A DC fast charging station can take 30-60 minutes to charge an EV battery to 80 percent, which sounds fast until you consider how much longer trips can add up. As battery technology improves, this time is expected to decrease

significantly. For example, Porsche has achieved a DC charging speed of 23 minutes to 88% for its Taycan model and claims that just 5 minutes can provide up to 62 miles of range. Tesla says that its Model S can achieve a range of 130 miles (about 35% of its total) with just 15 minutes of DC charging.

Charger Compatibility

In general, level 2 chargers are mostly coordinated, with all automakers except Tesla using the same type of charging port (Tesla drivers need an adapter). However, there are three different types of DC fast chargers:

SAE Combined Charging System (CCS): used by most manufacturers

CHAdeMO: used by Nissan and Mitsubishi

Tesla Supercharger: used exclusively by Tesla vehicles

If only because it differs from the universal access to gas stations enjoyed by gasoline-powered vehicles, this compatibility difference could be a barrier to widespread EV adoption.

Charging Pricing Structure

One of the new challenges is determining the rate of charge that will be applied to consumers each time they use the charging infrastructure's paid infrastructure. The charging process for electric vehicles includes several different pricing structures, unlike gasoline which is always priced per gallon. These differences can result in inconsistent pricing and inflated charging costs, which can create barriers to adoption due to user frustration and poor new experiences. Public charging stations may include per-session fees, per-minute fees or tiered pricing based on charging speed. EV drivers generally like the per-kWh pricing structure, which seems to be closest to the per-gallon pricing structure they're used to. Some states combine a per-kWh pricing model with tiers based on charging speed.

5.2 Recommendation

After conducting research from users and also from the state of development of the Malaysian automotive industry, especially for vehicles that use hybrid and electric, there are many challenges and continuous efforts are required from all parties to face the challenge - automotive development. hybrid and electric vehicle industry in the next 5 years in the Malaysian market. Although this is quite challenging to implement but it is not impossible to achieve it with close cooperation between industry players, government and consumers. Support from all parties is important to the success of every plan that has been done. The elements that need to be taken seriously and improved from the survey done and critical things so that consumers are more interested in owning hybrid and electric vehicles in the future because they are affordable vehicles and after-sales services are also plentiful and easy. to provide. From market issues regarding the challenges faced by manufacturers, after sales services and consumers such as manufacturers need to buy materials or tools at high prices which will cause the price of hybrid and electric vehicles to become more expensive. The range issue is also a concern due to the relatively short driving distance and the need to recharge. The limited choice of models at the moment is also a challenge for consumers to make the best choice. The issue of skilled manpower in the field of hybrid and electric vehicle repair also poses a challenge to after-sales service because currently technical colleges still use modules for conventional vehicles. Electric vehicle charging point infrastructure is also an issue for the expansion of hybrid and electric vehicle sales in Malaysia. In addition to the charging point, charging speed is also a challenge because the time taken is quite long which is a minimum of 1 hour at the moment with existing facilities. In terms of charging compactness is also an issue because not all vehicles can use the charging port. The final issue is about the charge that will be applied to the consumer each time using a hybrid or electric vehicle charger.

Purchase Cost

In order to overcome the problem of high cost of raw materials and components, manufacturers can sit down and discuss with the relevant ministry to overcome this problem. One way is to reduce taxes for these hybrid and electric vehicles. In the most literal sense, a CBU vehicle stands for Complete Built Car. Basically, this means that a CBU car is made in a foreign country, and imported into Malaysia as a fully operational vehicle. Normally, imported CBU cars can be subject to very high excise duties, ranging from 60% – 105%, which will increase the final price of the car. If using the CBU vehicle concept, manufacturers can save time and cost of building new vehicles and only need to brand everything according to the country of Malaysia. Another way apart from CBU vehicles is for cars imported into Malaysia as fully assembled operational vehicles but there is an option for CKD vehicles. CKD stands for Completely Knocked Down (CKD), is a car vehicle that has been completely assembled at a local manufacturing plant and indirectly enables CKD car models to qualify for government benefits and incentives, as well as excise duty exemptions. This means that CKD models are usually much cheaper than CBU models. The difference between CBU and CKD units is the price. A 20% difference in import duty will make a significant difference in the consumer's budget. On average, you can expect to save up to RM15,000 to RM20,000 on the CKD model. By using two methods, manufacturers do not need to incur high costs for the construction of new hybrid and electric vehicles, R&D costs and also the cost of raw materials including vehicle components.

Complete Built-Up (CBU)	Complete Knocked-Down (CKD)
Imported as fully finished (assembled) unit	Imported in parts and then assembled locally **Manufacturers may use local content for parts like tyres, windows and headlights.*
Higher import duty at 30% (for non-ASEAN countries)	Lower import duty at 10%
Purchase on release	Longer waiting time (up to a year)
E.g. Release date: May 2012 Mazda CX-5 (2WD High Spec): RM159,500	E.g. Release date: June 2013 Mazda CX-5 (2WD High Spec): RM144,125

Figure 41. Example Tax Vehicle CKD vs CBU

Anxiety Reach

Ways to overcome concerns about charging are like electric vehicle applications which are:-

- Using an EV app like Zap-Map or ABetterRoutePlanner used in the UK can really help your confidence and peace of mind when driving an EV. The app's functions can include finding your nearby location for charging points, estimating the percentage of battery used for a round trip and even making payments for your charges. They can take into account specific EV models, driving preferences and battery state of charge.
- Always be prepared i.e. always make sure your EV is fully charged overnight before a long trip, and make sure your final destination is capable of public or home charging.
- Always make it a practice to charge the vehicle when stopped, don't stop charging and this will be an efficient use of your time by taking any opportunity along the way and stopping for a coffee or going to the toilet taking the opportunity to charge your vehicle.

Limited Choice

Currently there are several options for hybrid and electric vehicles. Popular models that use hybrid and electric are Toyota, Honda, Hyundai, KIA, Mercedes, BMW and several other models. The government should give incentives and tax reductions to hybrid and electric vehicle manufacturers to encourage industry players to produce affordable vehicle models for motor vehicle users. in Malaysia.

Difficulty Finding Technicians

Currently, one of the biggest problems is the very low number of qualified skilled workers to accommodate the improvement of hybrid and electric vehicles in the Malaysian market. The best way is to add facilities at public and private skill training institutes in the field of service and repair of hybrid and electric vehicles to cover the lack of skilled manpower in the next 5 years because currently skill training institutes only offer conventional engine skill training even though hybrid vehicles have established in Malaysia since 1990. This is because demand from the industry is relatively low as most are focused on conventional engine vehicles. Customers have no choice and only send their vehicles to the manufacturer's service center because private workshops do not have the expertise. If a

training institute is set up from now on, the problem of qualified skilled manpower will be overcome within the next 5 years because training usually takes 2 years and trainees will be recognized with the Malaysian Skills Certificate Level 3 after completing the training and passing the prescribed final test by the Skills Development Department under the Ministry of Human Resources.

Charging Infrastructure

Currently Malaysia only has about 900 EV charging stations, as reported by Edgeprop Statement from senior director at the Malaysian Ministry of International Trade and Industry (Miti) Datuk Hanafi Sakri. In comparison, neighboring Singapore, currently has 3,600 charging stations to support its smaller population and size. Malaysia's target is to install 5,000 EV vehicle chargers nationwide in the future according to the deputy minister of science, technology and innovation (MOSTI), Datuk Ahmad Amzad Hashim. In terms of EV vehicle sales trends in Malaysia, there seems to be an increase to 2,631 units in 2022, up 860% from 2021; sales in 2023 are expected to be higher although only 274 new electric vehicles were sold in Malaysia in 2021, a big jump is expected for EV sales in 2022 after that, and it has been proven. The government with responsible ministries and departments hope to improve EV vehicle charging facilities in line with the encouraging improvement trend while being supported by automotive industry players for hybrid and electric vehicles. According to the statement of JPJ Director General Datuk Zailani Hj Hashim, according to the statement records of the Road Transport Department (JPJ), there are more than 10,000 electric vehicles registered in Malaysia until 2023.

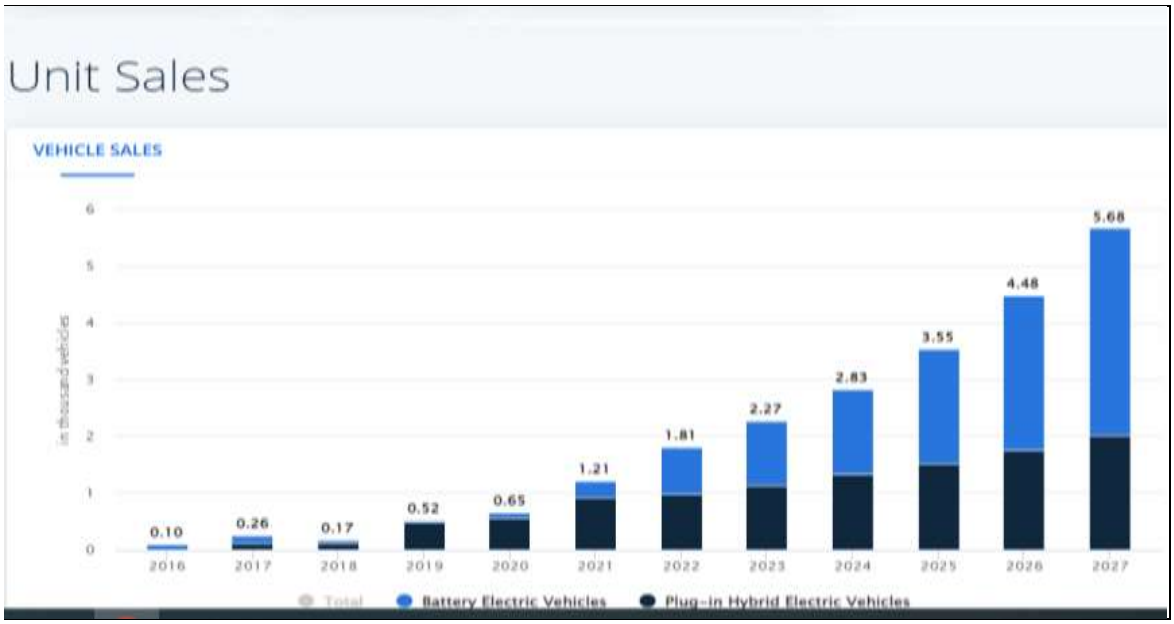


Figure 42. Total Sale Vehicle EV & PHEV in Malaysia (Source: Statista Market Insights)

Charging Speed & Charger Compatibility

Types of EV Chargers

Level 1 Charging : Slow Charger

Charging Output : 1.44kW – 1.92kW

Charging Time (for 40kWH cars): About 17 hours

Using a single phase, AC configuration

The charging unit is either untethered (detachable cable) or has a tethered cable. Usually used to charge home, workplace. A Level 1 EV charger is usually a power cord charger that is usually provided for free when you purchase an EV car. It's a simple charger that's compatible with a wall outlet in your home to start charging your car because it only needs a single-phase AC configuration. Due to their low charging output, these Level 1 chargers are more common for PHEVs or EVs that you only use for occasional short/weekend trips. A Level 1 charger is the type of charger you use overnight or plug and charge during your work hours. Usually owners will keep a charger in the car, in case they cannot find any charging point for their car.

Level 2 Charging : Fast Charger
Charging Output : 3.1kW – 22kW
Charging Time (for 40kWH cars): About 4- 8 hours
Uses single phase, 3 phase AC

The charging unit is either untethered (detachable cable) or has a tethered cable. Commonly used to charge homes, workplaces, public parking lots. Level 2 chargers are the type of 'box' chargers you usually see in public spaces, where people usually park their cars for 1-2 hours to 'charge' their vehicles while running errands (shopping, meetings, exercising). For those who drive an EV as a daily driven car, it is recommended to install a level 2 charger in your home for your own convenience. You will need to hire a third party installer to help you do the installation as it will involve wiring to ensure the safety of the home circuit. For level 2 charger, you can use single phase AC or 3 phase AC. Maximum output for single phase AC is 7.68kW while 3 phase AC is 22kW. Most home electrical configurations are single-phase AC, so upgrades are needed to support 3-phase charging. With an average charging time of 4-8 hours, it's definitely faster and easier than a level 1 charger.

Level 3 Charging : DC Fast Charger
Charging Output : 50kW – 120kW
Charging Time (for 40kWH cars): About 30 minutes – 2 hours
Using a Direct Current, DC Configuration.

The charging unit has a tethered cable. Usually found on the highway, RnR charging. Level 3 is the fastest EV charging level available. It is much more powerful than a Level 2 charger because it uses direct current (DC), so why you won't find anyone installing it in their home. Installing a Level 3 charger yourself will cost more than an EV car. Due to their high output capacity, level 3 chargers are usually found on highways or trails where long distance travel takes place. It can recharge an EV to 80% as fast as 20 minutes depending on the charging station model. However, the average EV will take about an hour at a standard 50kW fast charging point because the car will reduce the charging speed as the battery gets closer to its full charge.

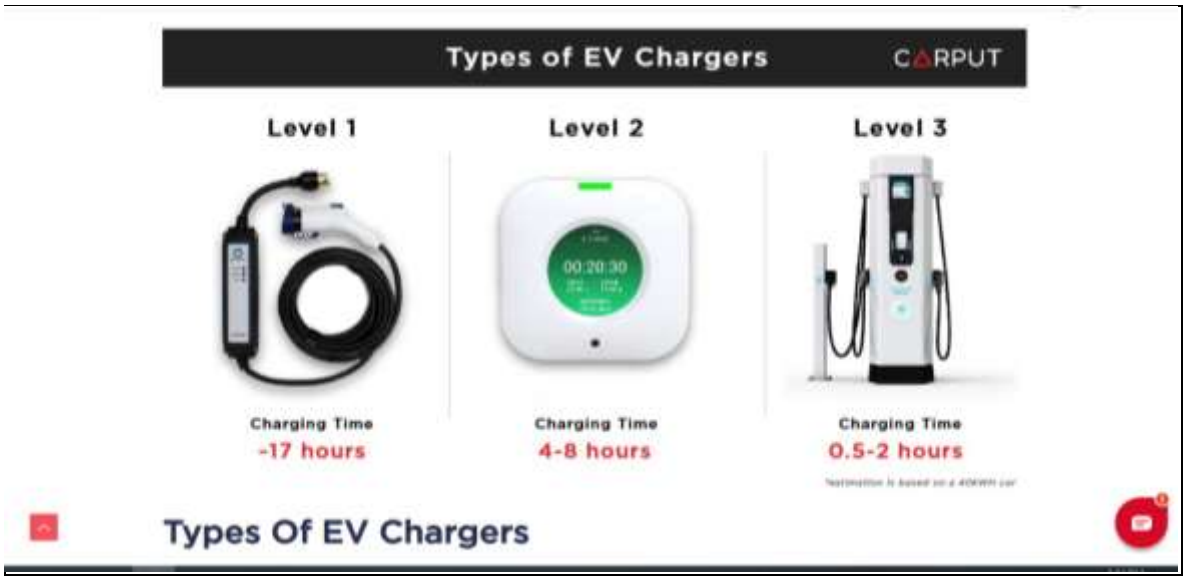


Figure 43. Types of EV Chargers

Charging Pricing Structure

In order to harmonize the charge price structure, the government and the responsible ministry need to study the price adjustment mechanism for each minute of the charge period. Industry players also have to play an important role in providing quality infrastructure at affordable prices. Currently there is no price standard set for the charging period and only according to the type of charging station. The price rate can be set by the host owner of the EV charging site or network, which affects the price as there are different positions for each. For example, a site host might want to offer a free public charge to bring more customers to its retail store or offer it as a perk to increase dwell time. However, charging by the minute, or cost per minute is the most commonly used, but you can also see the price per charging session and per kWh. When charging by the minute, the charging system will have a standard amount of electricity flowing into the car. There is no guarantee of how much electricity will flow into your vehicle, although most stations will offer guarantees such as a 20-minute supercharge to impress EV drivers. Different charging networks will incentivize proper use by charging electric vehicle drivers to idle. These fees also vary by network and location. For example, fees can range from $0.40 per minute to $1.30 per minute depending on location and charging type. Most chains no longer provide

fees or termination fees for members, but credit card fees vary across locations if you pay as you go. For the price rate structure, charging needs to be fine-tuned from time to time to get the right price and a win-win situation between service providers and consumers.

5.3 Limitations and Future Research Direction

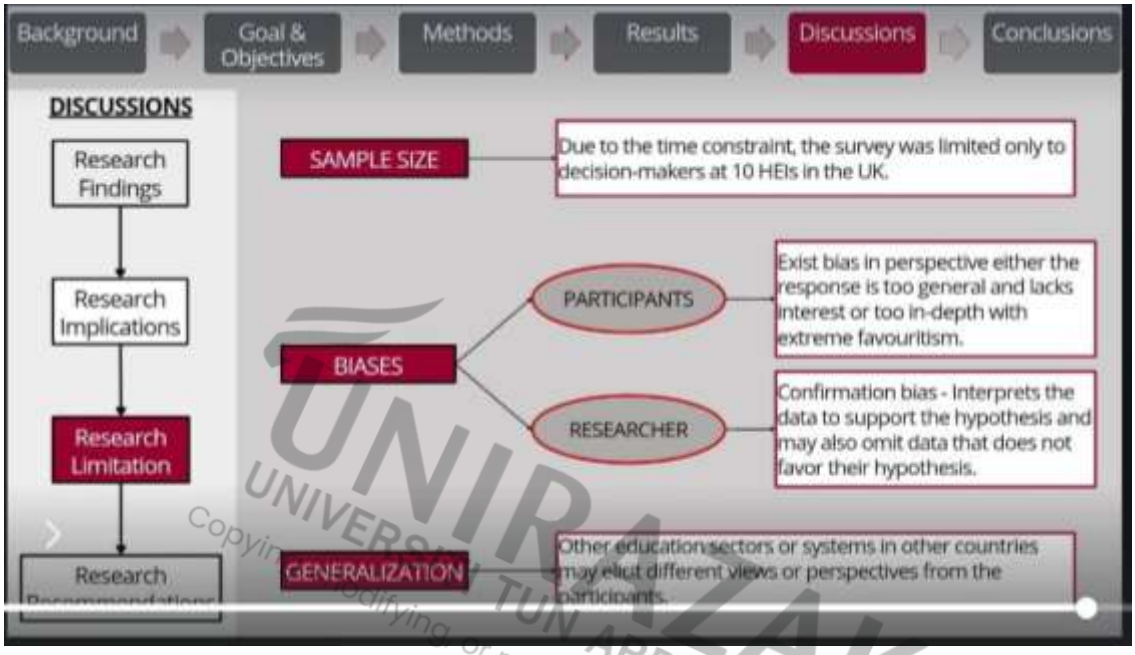


Figure 44. Limitations and Future Research Direction

Study limitations refer to study weaknesses in terms of what you believe the research lacks or how it could be improved. Another difference is that the scope and limitations are set before starting the study, while the limitations are clarified after the study is completed. For the limitations of this study, the target is motor vehicle users in Malaysia. This study is important to get an overview and user needs of what is needed in the future so that improvements can be made according to the wishes and needs of customers. The target is also according to the appropriate age level so that the answers and opinions given can be analyzed.

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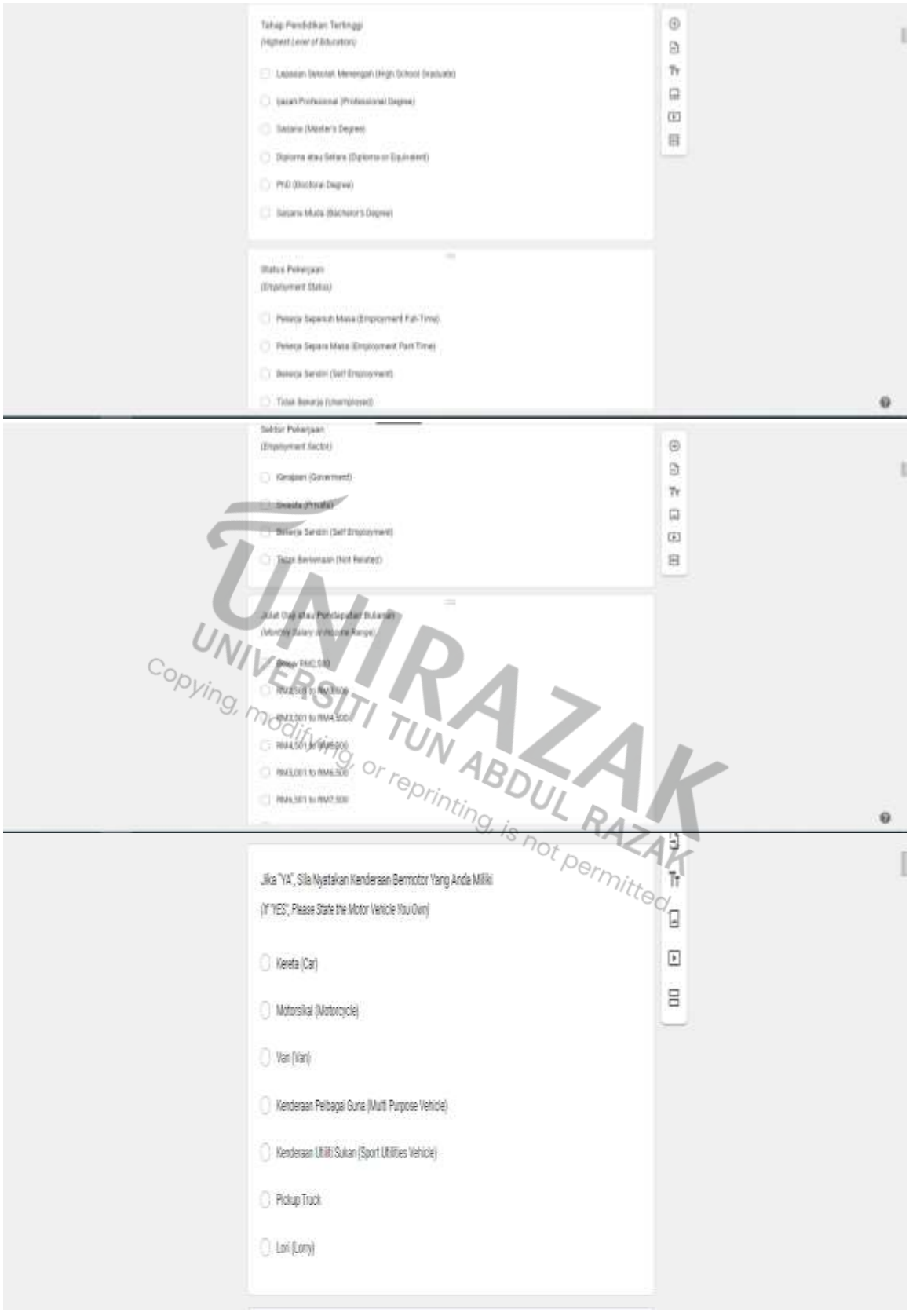
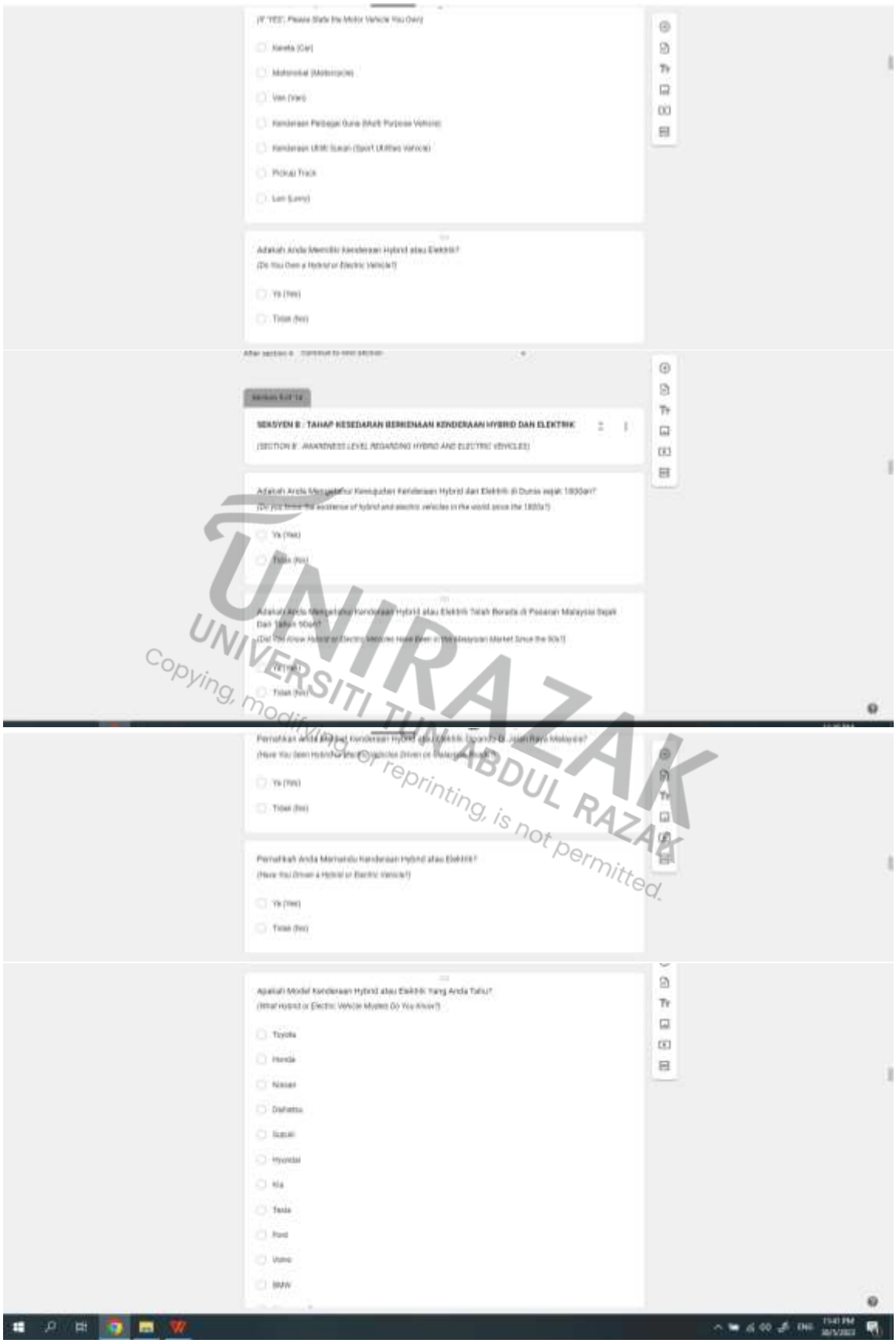
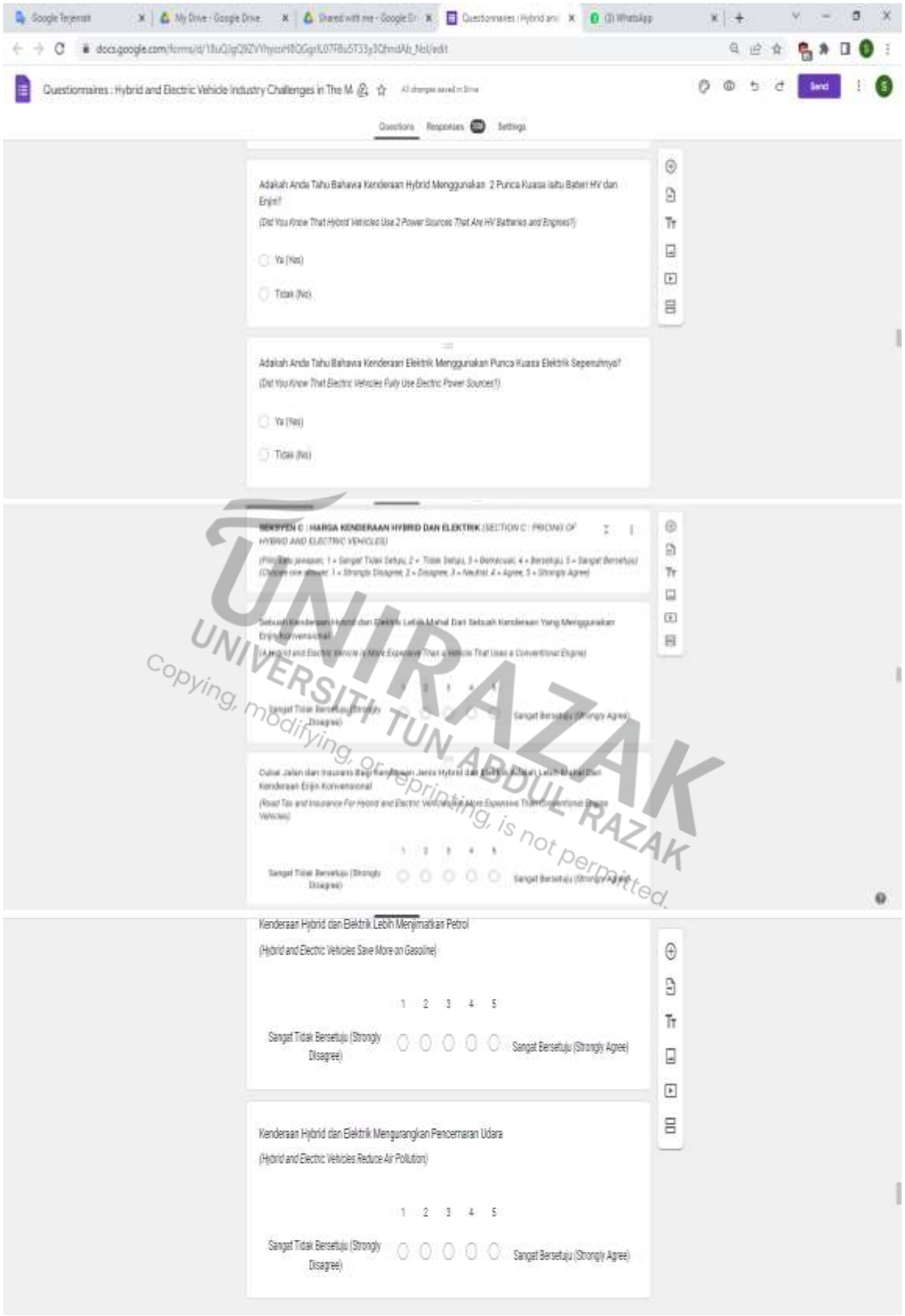
Attachment Questionnaire







Section 2 of 14

SEKSYEN D : ALAT GANTI KENDERAAN HYBRID DAN ELEKTRIK (SECTION D : HYBRID AND ELECTRIC VEHICLE SPARE PART)

(Pilih satu jawapan; 1 = Sangat Tidak Setuju, 2 = Tidak Setuju, 3 = Berkecuali, 4 = Bersetuju, 5 = Sangat Bersetuju)
(Choose one answer; 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

Alat Ganti Kenderaan Hybrid dan Elektrik Adalah Lebih Mahal dari Kenderaan Enjin Konvensional
(Hybrid and Electric Vehicle Spare Parts Are More Expensive than Conventional Engine Vehicles)

	1	2	3	4	5	
Sangat Tidak Bersetuju (Strongly Disagree)	○	○	○	○	○	Sangat Bersetuju (Strongly Agree)

Alat Ganti Kenderaan Hybrid dan Elektrik Sukar Untuk Dicari
(Hybrid and Electric Vehicle Spare Parts are Hard to Find)

	1	2	3	4	5	
Sangat Tidak Bersetuju (Strongly Disagree)	○	○	○	○	○	Sangat Bersetuju (Strongly Agree)

Kebanyakkan Alat Ganti Kenderaan Hybrid dan Elektrik Perlu Diimport Dari Luar Negara
(Most Hybrid and Electric Vehicle Spare Parts Need to be Imported from Abroad)

	1	2	3	4	5	
Sangat Tidak Bersetuju (Strongly Disagree)	○	○	○	○	○	Sangat Bersetuju (Strongly Agree)

Alat Ganti Kenderaan Hybrid dan Elektrik Perlu Dikendalikan oleh Orang Yang Mahir Dalam Bidang Ini
(Hybrid and Electric Vehicle Spare Parts Need to Be Handled by People Skilled in These Fields)

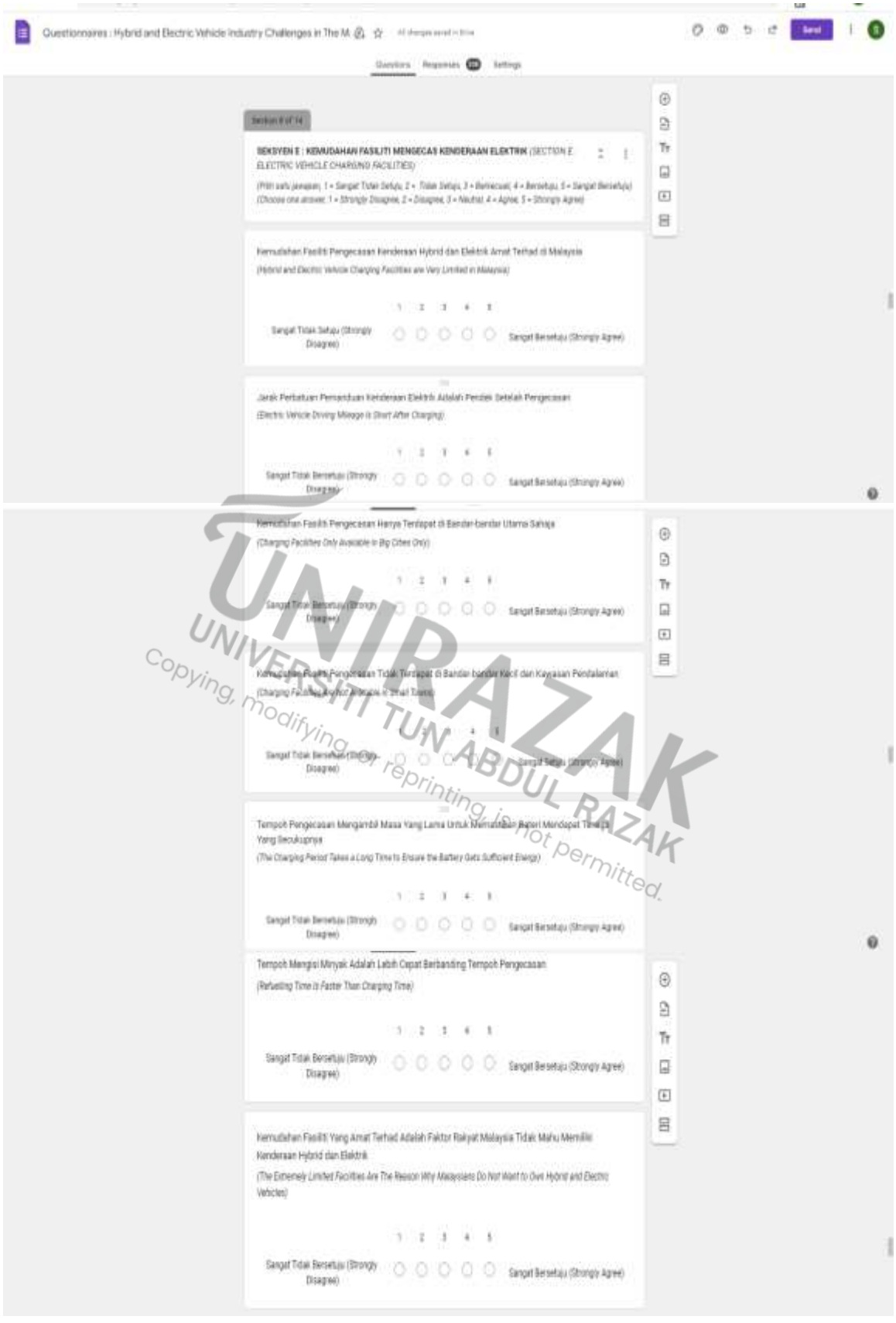
	1	2	3	4	5	
Sangat Tidak Bersetuju (Strongly Disagree)	○	○	○	○	○	Sangat Bersetuju (Strongly Agree)

Kadar Upah Untuk Menggantikan Alat Ganti Kenderaan Hybrid dan Elektrik Adalah Lebih Mahal
(The Labour Rate To Replace Hybrid and Electric Vehicle Parts are More Expensive)

	1	2	3	4	5	
Sangat Tidak Bersetuju (Strongly Disagree)	○	○	○	○	○	Sangat Bersetuju (Strongly Agree)

Harga Alat Ganti dan Kadar Upah Yang Mahal Salah Satu Faktor Untuk Anda Tidak Berminat Memiliki Kenderaan Hybrid dan Elektrik
(The Expensive Price of Spare Parts and Labour Work One of the Factors for You Not Interested in Owning Hybrid and Electric Vehicles)

	1	2	3	4	5	
Sangat Tidak Bersetuju (Strongly Disagree)	○	○	○	○	○	Sangat Bersetuju (Strongly Agree)



BEKSYEN F : SERVIS DAN PENYELENGGARAAN (*SECTION F : SERVICE AND MAINTENANCE*)

(Pilih satu jawapan; 1 = Sangat Tidak Setuju, 2 = Tidak Setuju, 3 = Berneutral, 4 = Bersetuju, 5 = Sangat Bersetuju)
(*Choose one answer; 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree*)

Penyelenggaraan Kenderaan Hybrid atau Elektrik Hanya Boleh Dilakukan Oleh Mekanik Yang Bertauliah Sahaja

(*Maintenance of Hybrid or Electric Vehicles Can Only Be Performed by a Certified Mechanic*)

	1	2	3	4	5	
Sangat Tidak Bersetuju (Strongly Disagree)	○	○	○	○	○	Sangat Bersetuju (Strongly Agree)

Mekanik Yang Bertauliah Adalah Personel Yang Kompeten di Dalam Bidang Penyelenggaraan Kenderaan Hybrid dan Elektrik

(*Certified Mechanics Are Competent Personnel In The Field Of Hybrid And Electric Vehicle Maintenance*)

	1	2	3	4	5	
Sangat Tidak Bersetuju (Strongly Disagree)	○	○	○	○	○	Sangat Bersetuju (Strongly Agree)

Mekanik Yang Tidak Bertauliah Tidak Boleh Menyelenggara Kenderaan Hybrid dan Elektrik

(*Non-Certified Mechanics May Not Maintain Hybrid and Electric Vehicles*)

	1	2	3	4	5	
Sangat Tidak Bersetuju (Strongly Disagree)	○	○	○	○	○	Sangat Bersetuju (Strongly Agree)

Bilangan Bengkel Yang Bertauliah Di Dalam Menyelenggara Kenderaan Hybrid dan Elektrik Amat Terhad di Malaysia

(*The number of certified workshops in maintaining hybrid and electric vehicles is very limited in Malaysia*)

	1	2	3	4	5	
Sangat Tidak Bersetuju (Strongly Disagree)	○	○	○	○	○	Sangat Bersetuju (Strongly Agree)

Kadar Upah Penyelenggaraan Kenderaan Hybrid dan Elektrik Adalah Tinggi

(*Maintenance Labour Work Rates for Hybrid and Electric Vehicles Are High*)

	1	2	3	4	5	
Sangat Tidak Bersetuju (Strongly Disagree)	○	○	○	○	○	Sangat Bersetuju (Strongly Agree)

Bilangan Bengkel dan Mekanik Kenderaan Hybrid dan Elektrik serta Kadar Upah Yang Tinggi Juga Antara Faktor Rakyat Malaysia Memilih Untuk Tidak Memiliki Kenderaan Hybrid dan Elektrik

(*The Number of Workshops and Mechanics for Hybrid and Electric Vehicles and The High Labour Work Rate Are Also Among The Factors That Make Malaysians Choose Not to Own Hybrid and Electric Vehicles*)

	1	2	3	4	5	
Sangat Bersetuju (Strongly Agree)	○	○	○	○	○	Sangat Tidak Bersetuju (Strongly Agree)

APPROVAL PAGE

TITLE OF PROJECT PAPER: HYBRID AND ELECTRIC VEHICLE INDUSTRY CHALLENGES IN THE MALAYSIAN AUTOMOTIVE MARKET IN THE NEXT 5 YEARS

NAME OF AUTHOR: SHAMSUL BIN MOHAMAD

The undersigned certify that the above candidate has fulfilled the condition of the project paper prepared in partial fulfillment for the degree of Master in Management.

SUPERVISOR

Signature: _____

Name :

Date :

ENDORSED BY:

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Graduate School of Business

Date: