# TECHNOLOGY MARKET ACCEPTANCE OF ELECTRIC MOTORCYCLE IN MALAYSIA

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SUPERVISOR'S APPROVAL

'I hereby declared that I have read this thesis and this research is sufficient in terms of scope and quality. This project is submitted to Universiti Teknikal Malaysia Melaka as a requirement for completion and reward Bachelor Degree in Technology Management (Technology Innovation) with Honours (BTMI).'

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Date : 8th June 2018

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A project paper submitted
In fulfillment of the requirements for the Bachelor of Degree in Technology Management (Technology Innovation) with Honours (BTMI).

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## DECLARATION

**“**I hereby declare that this project paper is the result of my own and independent work except the summary and experts that have been specifically acknowledgement”

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Date : 8th June 2018

# DEDICATION

This paper is dedicated to both my father and mother who always motivate me in completing this research. They always give me support and advice to me in order to fulfill the requirement of the research. Without their support and motivation, it will be impossible for me to complete the research.

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Last but not least, I would also like to express my appreciation to my family and friends who have given their hand along the way. Their loves and spiritual supports have always given me the strength to finish this final year project. Once again, thousand words could not fully express my thanks to them, but their kindness have graved in my heart all the time.

# ABSTRACT

Electric motorcycle has been exists in Malaysia but is has become unpopular available vehicles. Electric motorcycle is an alternative way to improve the sustainability of vehicle and it can give many benefits such as improving energy efficiency, reducing gas emission and air pollution, improving fuel consumption and saving costs. The aim of this study is to identify the technology diffusion strategies and to identify the factors that contribute to the innovation of electric motorcycle. The method used in this study is Quantitative method. The researcher has carry a survey by questionnaire to collect data and distribute to 115 samples. The data were analyzed using SPSS software to calculate the correlation between the factors and multiple regression analysis is to analyze multiple independent variables are related to a dependent variable. The researcher hopes this research can contribute to more production of the electric motorcycle in Malaysia because it can gives many benefits in many aspects as it is and innovation of green vehicles and improving sustainability.

Keyword: Electric Motorcycle, Energy Efficiency, Gas Emission, Air Pollution, Fuel Consumption, Cost.

*ABSTRAK*

*Motosikal elektrik telah wujud di Malaysia tetapi telah menjadi kenderaan yang tidak popular. Motosikal elektrik adalah cara alternatif untuk meningkatkan kemampanan kenderaan dan ia dapat memberi banyak faedah seperti meningkatkan kecekapan tenaga, mengurangkan pelepasan gas dan pencemaran udara, meningkatkan penggunaan bahan api dan menjimatkan kos. Tujuan kajian ini adalah mengenal pasti strategi penyebaran teknologi dan mengenal pasti faktor-faktor yang menyumbang kepada inovasi motosikal elektrik. Kaedah yang digunakan dalam kajian ini adalah kaedah Kuantitatif. Penyelidik telah menjalankan tinjauan dengan soal selidik untuk mengumpul data dan mengedarkan kepada 115 sampel. Data dianalisis dengan menggunakan perisian SPSS untuk mengira korelasi antara faktor dan analisis regresi berganda adalah untuk menganalisis pelbagai pembolehubah bebas yang berkaitan dengan pembolehubah yang bergantung. Penyelidik berharap penyelidikan ini boleh menyumbang kepada lebih banyak pengeluaran motosikal elektrik di Malaysia kerana ia dapat memberi banyak manfaat dalam banyak aspek kerana ia adalah dan inovasi kenderaan hijau dan meningkatkan kemampanan.*

*Kata Kunci: Motosikal Elektrik, Kecekapan Tenaga, Pelepasan Gas, Pencemaran Udara, Penggunaan Bahan Bakar, Kos.*

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| | | |
|---|---|---|
| EE | = | Energy Efficiency |
| GA | = | Gas Emission and Air Pollution Control |
| FC | = | Fuel Consumption |
| C | = | Cost |
| DV | = | Dependent Variable |
| IV | = | Independent Variables |
| SPSS | = | Statistical Package for the Social Sciences |

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# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction/Background of the Study

Transportation has been one of an important thing in our daily life. It has made our life easier from going one place to another and also help to move things by any possible ways no matter how far the distance is. On a public road, cars and motorcycles has been the most famous transport in Malaysia. According to Malaysian Transportation Ministry, total number of vehicles on the road in 2013, 2014 and 2015 are 17,368,234, 18,026,509 and 18,619,514 respectively. This is show that the number of vehicles on public road is increasing every year.

Although transportation is important, several recent studies have reported that the transportations sector is a significant greenhouse gas emission source as mentioned by Boukhnifer M., Ouddah N., Azib T., Chaibet A., (2016). This will cause the air pollution to the Earth. According to Velazquez L., Munguia N. E., Will M., Zavala A. G., Verdugo S. P., Delakowitz B., Giannetti B. (2015), carbon dioxide (CO2) emissions due to fossil fuel combustion were distributed by the transportation sector which is the second largest. In the USA (United States Department of State, 2010), this sector makes up 28 percent of the total greenhouse gas (GHG) emissions and 25 percent of GHG emissions in the European Union (European Commission, 2014) in reducing emissions, except for the

transportation sector (Heinrichs et al., 2014). Special attention must be paid to the need for decoupling transportation and CO2 for every other sector contributed. It is generally obvious that under this context, transportation contributes less to sustainable development; therefore, urgent solutions were required to make the transportation sector more sustainable. Rising fuel prices and the tightened emission legislation have led to an increasing effort in improving the fuel efficiency of automotive vehicles.

Technology nowadays has made so many innovation of the vehicles to improve and produce a better production. One of the technology that has been made is electric vehicles. According to Larminie, J., & Lowry, J. (2012), electric vehicles were first introduced in 1830s, and commercial electric vehicles were available by the end of the 19th century. Early on in the development of electric vehicles the concept was developed of the hybrid vehicle, in which an internal combustion engine driving a generator is used in conjunction with one or more electric motors. These were tried in the early 20th century, but recently have very much come back to the fore. The hybrid car is one of the most promising ideas which could revolutionize the impact of electric vehicles. The Toyota Prius is a modern electric hybrid that, it is said, has more than doubled the number of electric cars on the roads. There is considerable potential for the development of electric hybrids and the idea of a hybrid shows considerable promise for future development.

## 1.2 Problem Statements

Cars and motorcycles has been the most widely used transport on the public road in Malaysia. According to Department of Road Transport in Malaysia, the total numbers of cars and motorcycles in 2015 is 11,871,696 and 12,094,790 respectively. We all know that most of the road transportation (such as cars, motorcycles, buses, vans and lorries) use a non-renewable energy which is petroleum as its fuel substances. Therefore, the study of hybrid motorcycle is significant.

According to Ong H. C., Mahliaa T. M. I, and Masjuki H. H (2010), Transportation sector is one of the major components of globalization and makes a vital contribution to the economy, thus, this activity is major energy consumption and use most of the limited non-renewable energy that creates a negative impact to living environment. According to Malaysia Energy Information Hub, the final consumption of petroleum products (ktoe) from 2013 to 2015 is increasing from 12,656, 12,705 and 12,804. It is shown that the usage of petroleum is increasingly from year to year and the balance of petroleum is getting less since petroleum is a non-renewable energy.

Furthermore, as the fuel consumption increases year by year, the gas emission and carbon are also increasing and contribute to the air pollution thus effects the environment. According to Shahid, S., Minhans, A., & Puan, O. C. (2014), the consumption of both petrol and diesel has been increasing rapidly with growing motorization and increasing dependence on private modes. At present, transportation sector consumes about 36% of the national energy. Consequently, it has appeared as a major emitter of CO2. It is also responsible for other gases causing air pollution. In addition, Transport sector of Malaysia produced 42.43 million metric tons CO2 which shares 22.9% of total CO2 emission in Malaysia. Therefore, with the balance of the petroleum sources available, how many years can we still survive?

Back in the few years, a technology had come with the innovation of hybrid car. One of the strategy to save the energy and go sustainability is an innovation a hybrid car that use less fuel consumption and use the renewable energy to generate power to move the car. According to Romm, J. J., & Frank, A. A. (2006), a full hybrid, such as the Toyota Prius, can provide a fuel economy improvement of 60 percent or more. The biggest fuel savings achieved by a full hybrid vehicle derives from regenerative braking, a technology that captures as electrical power much of the energy normally lost as frictional heat. Furthermore, another major fuel-economy advantage in a full hybrid stems from its ability to use its electric motor and batteries to power the vehicle without

the engine. Thus, fuel can be saved by running the car as an electric vehicle when the engine would otherwise be burning fuel while idling or traveling at low speeds.

The technology has been always moving forward to improvise the system to produce more effective and better technology. Therefore, electric motorcycle has been introduced in late 1860s as it is an early reference that has been found in patents. The innovation of electric motorcycle has been growing from its present until today. It is an innovative technology that offer many benefits in many aspects. Unfortunately, the adaption of electric motorcycle in the transportation market in Malaysia is not that good. Since in Malaysia there are more number of motorcycles than cars on the road as mention above, it could be great to make an innovation of producing more electric motorcycle. Since the technology of electric vehicle had become a popular innovation nowadays, therefore it would be an idea to improvise the technology. The cost of producing an electric motorcycle could be less than a hybrid car because the capacity of engine of motorcycle is smaller than engine of car. This could help to gain sustainability in transportation sector and helps to reduce pollutions. This idea of innovation will also help to gain more efficiency of the usage of non-renewable energy, and reducing costs of petroleum expenses of an individual.

## 1.3 Research Questions

1.3.1 What are the technology diffusion strategy of Electric Motorcycle in Malaysia?

1.3.2 What are the factors that contribute to the innovation of Electric Motorcycle?

1.3.3 What are the relationship of the factors and Electric Motorcycle Market Acceptance?

## 1.4 Research Objectives

1.4.1 To determine the technology diffusion strategies of Electric Motorcycle in Malaysia.

1.4.2 To identify the factors that contribute to the innovation of Electric Motorcycle.

1.4.3 To uncover the relationship of the factors and Electric Motorcycle Market Acceptance.

## 1.5 Scope, Limitation And Key Assumption Of The Study

This research is focused on the factors of electric motorcycle in Malaysia. Therefore, the scope of this study is big as it is covered in Malaysia. The limitation of the study is that time and cost of the research as the researcher have a limit of time and need to reduce cost as low as it can since the researcher do not have any donation or sponsor to expand the study for the whole nation. Therefore, the researcher choose Melaka for the location of the study and selected to be the representativeness of the study's population.

There are also several assumptions that made purposely for this study. First, this research is assume all the respondents are answering with honestly. Second, this study was only focuses on respondents' behavior and assume that the respondent willing to share their knowledge about the innovation of the technology stated.

## 1.6 Importance Of The Study

The knowledge this study generates will contribute in two ways; in terms of theory, this study provides an empirical understanding on the factors that contribute to the innovation of hybrid motorcycle in Malaysia; and in terms of effects; to understand the benefits and positive effects of the innovation of electric motorcycle in Malaysia which will impact in many aspect such as environment and economic in Malaysia.

## 1.7 Summary

This chapter is structures as the introduction of the whole research. It introduces the topic of the study including the background, the problem statements, the research questions and research objectives, scopes, limitation and key assumption of the study as well as the importance of the study.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 INTRODUCTION

This chapter deals with the assessment of literatures which relate to the topic of the research which is the innovation of electric motorcycle in Malaysia. Several literatures would be selected and relevant areas would be reviewed. In this chapter, the researcher will define the meaning of electric vehicle, reviewing the electric motorcycle, identify the factors of the innovation and determine the technology diffusion strategies. This chapter provides information about aspect of previous works which related to this study. In other words, a number of presentations culled from various sources are under review here.

## 2.2 Electric Vehicle

Electric vehicle was first introduced in 1830s, and the commercialization of the electric vehicle were available by the end of 19$^{th}$ century. According to Larminie, J., & Lowry, J. (2012), early on the development of electric vehicles, the concept was developed of the hybrid vehicle, in which an internal combustion engine driving a generator is used in conjunction with one or more electric motors. These were tried in

the 20th century but recently have very much come back to the core. In addition, electric vehicles have