



DRIVER INTENTION TO USE ELECTRIC CARS USING TECHNOLOGY ACCEPTANCE MODEL

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ABSTRACT

A systematic transportation system is vital for the development of a country. In Malaysia, the high dependence on private cars is caused by inadequate public transport that does not meet the general needs of commuters. This study was conducted to identify the factors that contributed to drivers' intention to use electric cars as a greener alternative to fuel-powered vehicles. To explore this issue, Technology Acceptance Model (TAM) was employed to predict acceptance of electric cars based on driver intention. Self-administered questionnaires were distributed to 217 car drivers in the Batu Pahat district. Correlation and regression analyses were performed to determine the relationship between the TAM constructs and the intention to use electric car. Results showed that all constructs were found to be statistically significant. In addition, Perceived Ease of Use was a stronger factor that contributed to drivers' acceptance to use electric cars compared to Perceived Usefulness. The level of the acceptance was highly positive.

Keywords: private vehicles, technology acceptance model, driver intention, electric cars.

INTRODUCTION

In Malaysia, transportation system plays an important role in development of the country. The transportation system is an important communication system to achieve a particular purpose. Various studies have been conducted to produce and improve the transport system that would meet the needs of users, particularly in relation with comfort, safety, reliability and sustainability. Private car ownership in Malaysia is rising year by year. The increased use of private vehicles is due to inadequate public transport that does not always meet the general requirements of the public. High private vehicle usage will cause several issues, such as traffic congestion, accidents, parking shortage and air pollution (Abd Rahman, 2007). Fossil fuel availability and strict regulations on carbon emission are major concerns and some of the biggest challenges faced by automotive industries. Registered vehicles have increased to 22,702,221 in 2012 with 92.3% of them being private vehicles, including cars and motorcycles (Jabatan Pengangkutan Jalan, 2013). It was estimated that motorised vehicles contributed 68.5% of the global emission from fossil fuel (Jabatan Perangkaan Malaysia, 2013). The energy demand from the transportation sector in Malaysia accounted for about 40%, hugely depending directly on fossil fuels (Abidin *et al.*, 2004).

Motivated by energy efficiency and emission concerns, electric cars were introduced in Malaysia as one of the solution to reduce fossil fuel dependency and carbon emission generated from the transportation sectors. There is agreement that the use of electric cars is a viable sustainable strategy. Electric cars have no impact on the greenhouse and air pollution, and do not produce lot of

noise (International Energy Agency, 2011). As the introduction of electric vehicles is relatively new in Malaysia, this study was undertaken to determine the factors that influence drivers' intention to use electric cars. To explore this study, Technology Acceptance Model (TAM) was used to predict acceptance of electric cars.

Technology Acceptance Model (TAM) was first introduced and developed by Fred Davis in 1986. TAM is considered as an influential extension of theory of reasoned action (TRA) (Ajzen and Fishbein, 1980). According to TAM, one's actual use of technology system is influenced directly or indirectly by the user's behavioral intentions, attitude, perceived usefulness of the system, and perceived ease of the system. TAM also proposes that external factors affect intention and actual use through mediated effects on perceived usefulness and perceived ease of use. Two cognitive beliefs are posited by TAM: perceived usefulness and perceived ease of use. Perceived Usefulness indicates the extent to which individuals believe the use of particular systems would improve their job performance, whereas the factor perceived ease of use indicates to which extent individuals believe the use of particular system will be free by effort (Ambak *et al.*, 2013).

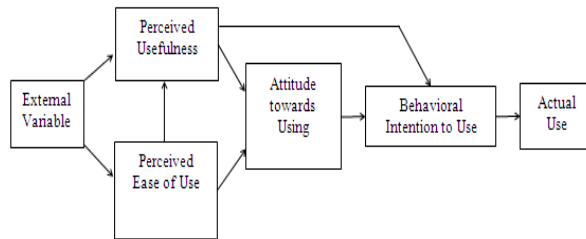


Figure-1. Original Technology Acceptance Model (TAM) (Davis 1989; Davis *et al.* 1989).

METHODOLOGY

This study employed self-administered questionnaire as a research instrument. The questionnaire was developed based on the Technology Acceptance Model (TAM). The questionnaire was divided into two parts, the first part was the information of the respondents, the second part was a questionnaire based on the Technology Acceptance Model (TAM).

Pilot study

Prior to the actual study, a pilot study was conducted to ensure that the survey met the objectives of the study. Twenty respondents (car users) were randomly selected to answer the questionnaire form. Cronbach Alpha scores were used to determine the reliability of internal consistency of the questionnaire items.

Data collection method

The self-administered questionnaires were distributed in several public places around Batu Pahat, including shopping centers, police station, bus terminal, restaurants and banks. Respondents were randomly selected in terms of race, gender, ethnicity, education level, age, status of respondents and others. A total of 250 respondents were targeted as the study sample based on gender population in Batu Pahat. However, only 217 respondents answered the questionnaires completely. Then the Statistical Package for Social Sciences (SPSS) version 16.0 was used to analyze the data obtained.

RESULT AND DISCUSSIONS

Descriptive data

Descriptive data is used to describe the characteristics of variables (Chua, 2014). Table-1 presents the demographic characteristics of the respondents. The statistical analysis was based on the 217 respondents. The gender mix was good with 53.0 % of male respondents and 47.0% of female respondents. Most of them were aged 35 and above (29.0%). Besides that, 45.6% of the respondents stated SPM as their highest education level, which made up the largest portion of education level among respondents. About 41.5% of the respondents were working in the private sector and earned monthly income

averaging below RM 2000 (34%) and between RM 2001 and RM 3000 (34%). Also the descriptive statistics showed that there were more married respondents (51.2%) than single respondents (48.8%). Another demographic question examined whether the respondents possessed car driving licence or not. Only 8.3% did not possess any licence while the rest of respondents had a car driving licence, i.e. class D licence (81.1%) and have 10 years and above driving experience (32.7%). 94.0% respondents said that they have never driven an electric car, while only 12% of the respondents rarely had driven an electric car. It showed that, the use of electric is still low and is at an early stage in Malaysia. However, majority of respondents have intended to use electric cars everyday (53.3%) due to the advantages of electric cars.

Table-1. Demographics of respondent (N=217).

Demographic	Frequency (n)	Percent (%)
Gender		
Male	115	53.0
Female	102	47.0
Race		
Malay	160	73.3
Indian	33	15.2
Chinese	21	9.7
Others	3	1.4
Age		
20 and below	12	5.5
21 to 25	56	25.8
26 to 30	59	27.2
31 to 35	27	12.5
35 and above	63	29.0
Education Level		
Higher Institution	48	22.1
STPM/Diploma	70	32.3
SPM and below	99	45.6
Occupation		
Government	70	32.2
Private Sector	90	41.5
Self-Employer	32	14.7
Not Working	7	3.2
Student	1	8.3
Income Per Month		
Below 2000	74	34.1
2001 to 3000	74	34.1
3001 to 4000	45	20.7
4001 to 5000	19	8.8
5000 and above	5	2.3
Marital Status		
Married	111	51.2



Single	106	48.8
Type Of License		
Full (D)	176	81.1
Probation (P)	18	8.3
Learning (L)	8	3.7
No License	18	8.3
Driving Experience		
Below 2 years	40	18.4
2 to 5 years	52	24.0
6 to 10 years	54	24.9
Above 10 years	71	32.7
Driving Experience of an electric cars		
Never	204	94.0
Rarely	12	5.5
Modest	1	0.5
Frequently	0	0
Very Regularly	0	0
Intention to use		

Electric cars		
Once a week	53	24.4
Twice a week	18	8.3
4 times a week	14	6.5
5 times a week	16	7.4
Everyday	116	53.5

Correlation analysis

Correlation is a relationship between the variables and the strength of the correlation is represented by a correlation coefficient (Chua, 2014). Table-2 shows the correlation between all the TAM variables. The results of the analysis showed that all relationships between the dependent and independent variables were highly and moderately correlated, bearing positive linear relationships that were significant at 0.01 ($p < 0.01$).

Table-2. Correlation analysis.

		Perceived ease of use	Perceived usefulness	Attitude toward using	Behavioral intention to use
Perceived Ease of Use	Pearson Correlation	1			
Perceived Usefulness	Pearson Correlation	.532**	1		
Attitude Towards Using	Pearson Correlation	.587**	.494**	1	
Behavioral Intention to Use	Pearson Correlation	.571**	.460**	.726**	1

** . Correlation is significant at the 0.01 level (2-tailed)

Multiple regressions

Multiple regressions was used to identify changes in two or more factors (independent variables) that contribute to the change in the dependent variable (Chua, 2014).

Multiple regressions for perceived ease of use, perceived usefulness and attitude towards usage of electric car

The multiple regression for the first model between Perceived Ease of Use, Perceived Usefulness and Attitude toward Using Electrical Cars. The R square (R^2) value is 0.385 which shows that 38.5% change in the dependent variable (Attitude toward using) is due to change in the independent variable (Perceived ease of use and Perceived Usefulness).

The ANOVA summary for dependent and independent variables showed a significant relationship ($p=0.000$) between the dependent variable (Attitude towards using) and the independent variables (Perceived ease of use and Perceived usefulness).

Table-3 shows the result of multiple regression for the model analysis. Two independents were tested, perceived ease of use and perceived usefulness to predict attitude as the dependent variable. Both of independent variables were significant to predict attitude towards using electric cars. Independent variables related to perceived usefulness ($\beta=0.254$) showed strong relationships ($p < 0.005$) but the independent variable, perceived ease of use, was found to be the most dominant factor ($\beta=0.452$) for attitude towards using electric cars.

**Table-3.** Multiple regressions for perceived ease of use, perceived usefulness and attitude towards using.

		Unstandardized coefficient		Standardized coefficient	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.206	1.055		3.988	.000
	Perceived ease of use	.375	.052	.452	7.167	.000
	Perceived usefulness	.221	.055	.254	4.027	.000

Dependent variable: Attitude towards using

Multiple regression for attitude towards using and behavioral intention to use electric car

The multiple regression for the second model between Attitude Towards Using and Behavioral Intention to Use resulted in an R square (R^2) value of 0.526 which shows that 52.6% change in the dependent variable (behavioral intention to use) is due to change in the independent variable (attitude towards using).

The ANOVA summary showed a significant relationship ($p=0.000$) between the dependent variable (behavioral intention to use) and the independent variable (attitude towards using).

Table-4 shows the result of multiple regressions for the model analysis. The independent variables were related to attitude towards using ($\beta=0.726$), having a strong relationship ($p<0.05$) with behavioral intention to use electric cars.

Table-4. Multiple regressions for attitude towards using and behavioral intention to use.

	Model	Unstandardized coefficient		Standardized coefficient	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	-.275	.768		-.359	.720
	Attitude Toward Using	.731	.047	.726	15.500	.000

Dependent variable: Behavioral intention to use

Based on the result, the relationship between perceived ease of use and attitude towards using shows a positive association that is significantly linear. This shows that the higher the perceived ease to use, with the stronger one's attitude towards using electrical cars. For the relationship between ease of use and attitude towards using, results show that the relationship of these two variables is positively linear and significant. For the relationship between perceived ease of use and perceived usefulness, these two variables are positively linear and significant as well. Analysis of correlation between these

variables and attitude towards using shows that they were positively linear and significant.

From the regression analysis, the Perceived Ease of Use was the most dominant factor in Attitude towards Using compared to Perceived Usefulness. The results also showed a significant relationship between these two variables. As for the relationship between Attitude toward Using and Behavioral Intention to Use, it was found that Attitude towards using significantly affects the Behavioral intention to use electric cars.

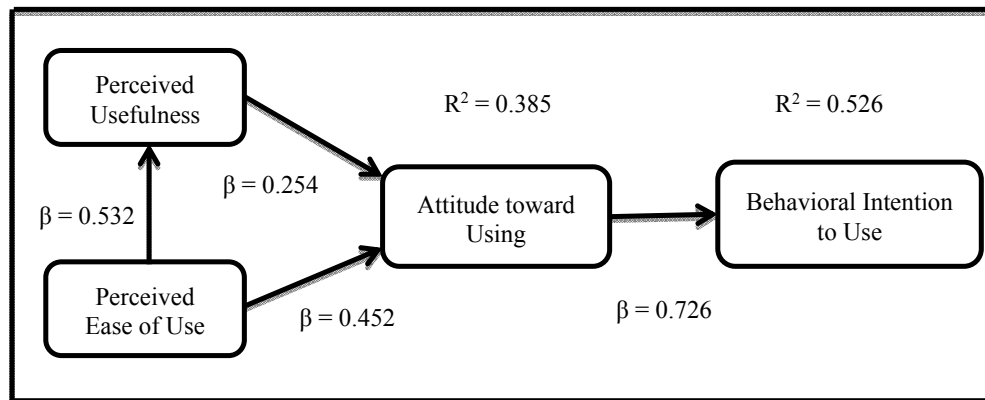


Figure-2. Technology Acceptance Model (TAM) to predict behavioral intention to use electric car.

CONCLUSIONS

The use of electric cars in Malaysia is in its early stages. Nevertheless, the benefit of electric cars is acknowledged by car drivers because of its high efficiency and environmental friendliness. Since the electric car industry is still new in our country, it is important to know the opinions of car drivers on electric cars. Technology Acceptance Model is a widely known and useful model to study behavior intention related to Information Technology and technological products. Two main TAM constructs (factors) that influence users to use electric car are namely Perceived Usefulness and Perceived Ease of Use. Findings show that the Perceived Ease of Use is a stronger factor in influencing drivers' intention to use electric cars. Beside that, the level of the acceptance of electric cars based on intention is highly positive. In conclusion, drivers have the intention to use electric cars and it seems a better choice instead of using conventional (combustion) cars.

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