[MAN 5] EXPLORATORY STUDY ON GREEN EMISSION TECHNOLOGY IN AUTOMOTIVE INDUSTRY

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ABSTRACT

Emission is anything that's been released or discharged to the world such as car exhaust, burps, and radio broadcasts. The automotive industry plays a significant role and main functions in the vehicle system. The number of vehicles on the roads is increasing day by day due to increased living standards and population. The main objective of this study is to explores the relationship between performance expectancy (PE), effort expectancy (EE), social influence (SI), facilitating conditions (FC) towards behavior intention (BI) and use behavior (UB) using UTAUT and to analyze green emission technology acceptance level in the automotive industry. The data will be collected through a unified theory of acceptance and use of technology (UTAUT) questionnaire survey. The data obtained will be processed using program Statistic Package for Social Science (SPSS). This study pointed behavioral intention has the highest influence on the use behavior by 61%. This study has found that environmentally friendly vehicles are a necessity in the future as conventional vehicles that use ICE using hydrocarbon fuels and cause environmental pollution problems caused by a large number of vehicles on the road.

Keywords: *green emission, automotive industry, technology acceptance, UTAUT*

INTRODUCTION

The vehicle is a necessity and is regarded as the most important man-made cause people need vehicles to commute from one place to another. The automotive industry plays an important role in the vehicle system. The number of vehicles on the roads is increasing day by day due to increased living standards and population (Aditya, 2015). Then, vehicle manufacturers can incorporate elements of green technology in transport infrastructure and vehicles, in particular, biofuels and public road transport and use energy sources that reduce environmental pollution such as diesel, hydrogen, batteries, hybrids and so on (Muhammad, 2014). Green technology can help conserve and minimize the adverse effects on the environment. Technology manufacturing of vehicles moving towards the transition from fossil based fuels to more environmentally friendly. It is aligned with the awareness of the need to develop green technology. In addition to hybrid cars that combine two fuel sources are now beginning to demand and growing rapidly in the country, fuel efficiency, alternative fuels, electric cars, and emission reduction is the trend nowadays. Survey on the future of green vehicles and green vehicle manufacturing and benefited a highly lucrative. Additionally, car manufacturers are also turning to the electricity consumption of petroleum entirely. Green vehicles are now the most important areas in the automotive industry. The level

of innovation in the design of green vehicles is extraordinary, with the power electronics and smart grid technology. Often the use of hybrid electric vehicles (HEV), many using electric mode only and therefore no exhaust gas pollution that occurs. Exhaust gas emissions will only happen if the HEV accelerate on the road or overtaking another vehicle at high speed. Therefore, technology experts have raised the prestige of the vehicle industry to a position that could be considered to help solve environmental problems (Wan Ahmad, 2013).

PROBLEM STATEMENT

Emissions are another big problem with vehicles that run on gas. Greenhouse gases are disastrous to the environment, which is one of the primary reasons so many automakers started experimenting with hybrid and electric cars in the first place. As a result, manufacturers are now attempting to cut down on emissions in gas-powered cars, hybrids, and EVs (Anthony, 2016). Although hybrid technology is already quite widely used, but there is still much space should be improved, especially consumer perception. A conservative attitude and a 'wait-and-see' is not helpful to use widely HEV. Today, the level of public awareness of green technology in the automotive industry is still low and has not reached a satisfactory level. The proof can be seen when many factories that emit black smoke harmful. Similarly, the fuel consumption of motor vehicles that are worrying (Laupa Junus, 2015). The main objective of this study is to explores the relationship between performance expectancy (PE), effort expectancy (EE), social influence (SI), facilitating conditions (FC) towards behavior intention (BI) and use behavior (UB) using UTAUT and to analyze green emission technology acceptance level in the automotive industry.

LITERATURE REVIEW

UTAUT was developed by Venkatesh that consists of four main key constructs such as performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC). Then, four main key constructs are independent variables which influence dependent variables, behavioral intention and use behavior. Through the four major concepts, gender, age, race or indirectly affect the dependent variable. Venkatesh, clarify that which being viewed as a critical predictor to use technology is of behavior intention. In the UTAUT model, performance expectancy, effort expectancy, and social factors have a significant positive impact on behavioral intention, which together with the facilitating condition which have a significant positive impact on use behavior. The relationship of the interaction of each performance expectancy, effort expectancy and social influence with each age and gender; interaction with each experience by effort expectancy and social influence; and the interaction of voluntariness and social factors on behavioral intentions are also available. Finally, there is the impact of facilitating interaction condition, age and experience and ease conditions on use behavior (Venkatesh et al. 2003). Details discussions are as following.

Performance expectancy is referring the level of individual beliefs that use this system will help him to achieve gains in work performance (Venkatesh et al., 2003). Performance expectancy is the average of influence on behavioral intentions by gender

and age as the hypothesized. The green emission technology is more environmentally friendly, economical use of fossil fuels and most importantly help reduce carbon gas emissions are the main cause of the greenhouse effect. Two brands of the world's largest car manufacturers namely Honda and Toyota for example, have their respective commercialize hybrid technology vehicles is the Toyota Prius and Honda Insight. The government's effort in the transport sector is a combination green technology in of transportation infrastructure and automobile, especially in biofuels and public transport. In terms of community, green emission technologies can improve air quality, thermal and sound environment. For example, the use of a hybrid engine cars. This can improve the comfort and health of city residents, reducing local infrastructure problems and improving the quality of life (Divia Riga, 2015).

Effort expectancy being intended is the standard that easily related to the use of the system (Venkatesh et al., 2003). Effort expectancy is to average the influence on behavioral intention by gender and age, and experience as the hypothesized. Then, the government plans to build 125,000 electric vehicle charging station infrastructure and increase the market for electric vehicles to 202,000 units for the period up to 2020. The creation of the hybrid system is not going to be easy but car manufacturers regarded it as a challenge and one thought, the response to the extraordinary Prius cars in line with consumer awareness about the importance of the environment (Bernama, 2016). Toyota Motor Corporation (TMC) proclaim that collective sales of hybrid cars, the company managed to reach number 5, 125, 000 million units for the global market. Following the good response received, Toyota Motor Corporation (TMC) plans to further improve performance, reduce costs and expand the product line of hybrid vehicles that are appropriate to the user. The general acceptance of hybrid cars is seen keeping with the principles of its creation as environmentally friendly vehicles (Berita Harian, 2013).

Social influence is well defining as the level of individual assuming that the significant others believe that he needs to use the new system (Venkatesh et al., 2003). Social influence is to medium the influence on behavioral intention by gender and age, and experience, and volunteers of the system as the hypothesized. Until now it was found that the level of public awareness of green technology has not yet reached a satisfactory level. The evidence still many factories which release black smoke that is dangerous, motor vehicle fuel usage that so worrying, natures that increasing destroyed, rivers that are dirty and carbon release on air. Two options are environmentally friendly vehicles are the solution for us in reducing the effect of environmental pollution. However, still not widely used by people due to the relatively costly price. The main problem of electric vehicles is currently a relatively limited way with an average distance of less than 150km. Both battery charging time is relatively long for a return to full power. There is reaching 8 to 10 hours (Laupa Junus, 2015).

Facilitating conditions is indicating that the organizational and technical infrastructure exists to support the use of the system at the level of the individual believe (Venkatesh et al., 2003). Medium the influence on behavioral intention by age, and experience as the hypothesized that stated. In the meantime, the National Automotive Policy 2014 emphasizes on Malaysia as a regional hub for the development of energy-efficient vehicles (EEV). This policy is expected to help the industry local vehicle manufacturers are focusing more on the development of energy-efficient vehicles. Previously, the government gave tax cuts to the use of green vehicles such as the Toyota Prius, Nissan Serena and also Honda Insight with the expectations of users in these countries will be

tempted to use such vehicles. Today, most consumers who appreciate nature choose to buy and use gasoline-electric hybrid vehicles and the number of users who buy eco-friendly cars is increasing. environmental friendly vehicles are growing vigorously develop electric vehicles. It is the most effective way to reduce exhaust fume pollution because it is a zero emission or without smoke pollution. This vehicle is powered solely by the battery as a power source. But it still remains a constraint to commercialization is difficult to prosecute because there are no charging facilities suitable for the public and requires a relatively long time for the battery is fully charged and re-powered. The distance is also quite restricted but it's getting better and is suitable for use in city areas. the growing technology has a clear future and gaining attention (Muhammad, 2014).

Behavioral intention as stated is the degree of a person's willingness to use and conduct the new information technology (Venkatesh et al., p. 2003). The last 20 years many investments have been made by five leading vehicle manufacturers and other companies that support towards enhancing research and development (R&D) to produce a variety of new technologies. This led to the development of various hybrid configurations that can reduce fuel consumption up to reach 20 km / liter. In addition, efforts to reduce the size of the coupling of the engine and the motor as the prime mover of hybrid vehicles has enabled the plant to be used in medium and small-sized vehicles. Although hybrid technology is already quite widely used, but there is still much space should be improved, especially consumer perception. The only problem today is the perception of people who want to try a hybrid vehicle. They are intimidated by the executive car dealers Hybrid cars are more expensive than the regular variants for high capital investment to develop hybrid technology. There is also concern about battery life. It is understood that guarantee (warranty) given by the company in Malaysia shorter than in Europe, which for 10 years. Engineers from Japan to ensure the lifespan of the first generation Prius, for example, still works well today even used as taxis in Tokyo (Iskandar Hasan, 2015).

Use behavior was measuring the actual frequencies of the user in technology use (Venkatesh et al., p. 2003). The race among automobile manufacturers is healthy because every producer is currently pursuing the needs of consumers and the government, which sets some strict measures such as tax penalties including a carbon tax as well as to motivated the use of green vehicles such as low level or zero emission. Users can change the use of the gasoline engine and battery at any time, in addition to automatically ignited. Using smart technology termed 'regenerative braking', when the hybrid car slows down, the system captures the energy and regenerate brake energy to recharge the battery. To really enjoy the savings, a hybrid car owner must also change the driving style. Hybrids save during congestion. But if driven at high speed on the highway, its fuel costs as well as regular engines (Wan Ahmad, 2013).

THEORETICAL FRAMEWORK

This study focuses on to explore the relationship between all variable in UTAUT for acceptance green emission in automotive industry with the original UTAUT findings and explore whether context specific constructs should be added to UTAUT, specifically, constructs related to green technology. The basic of the UTAUT Model is shown in Figure1.
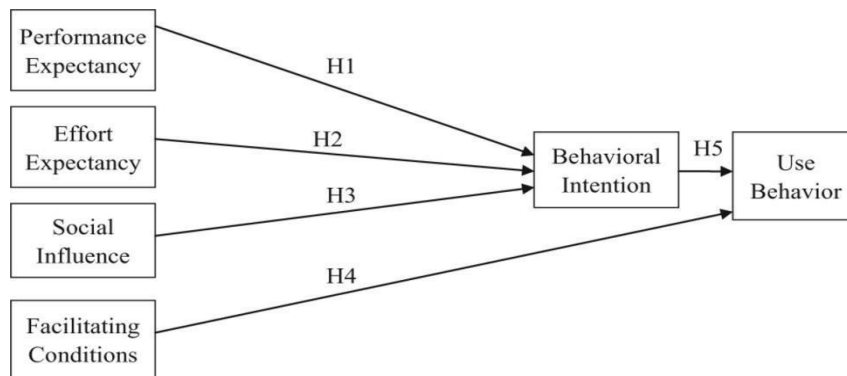
Figure 1
Unified Theory of Acceptance Use of Technology

HYPOTHESES

The following hypotheses are proposed:

The evidence is HEV if it helps them to accomplish their personal performance objectives in an efficient way that people will be more likely to utilize HEV (Wang & Wang, 2010). Therefore, we hypothesize:

H1: There will become a significant positive relationship between performance expectancy and behavioral intentions to analyze green emission technology acceptance level in automotive industry.

The evidence is according to Wang and Wang (2010), HEVs is that of accessibility of these vehicles to people and the degree of effort required to use this sustainable technology. The technology or product needs to be effortless to utilize, therefore, the more complex the system, the prospect of adoption 17 will be lower and the implication for this study pertaining to HEV. Therefore, we hypothesize:

H2: There will become a significant positive relationship between effort expectancy and behavioral intentions to analyze green emission technology acceptance level in automotive industry.

The evidence is these factors are important for adoption decisions as consumers changing their behaviors based on the expectations of others or their take on other's viewpoints and opinions (Venkatesh et al., 2003). Therefore, we hypothesize:
H3: There will become a significant positive relationship between peer influence and behavioral intentions to analyze green emission technology acceptance level in automotive industry.

The evidence is Zhou state that the most important factor that determines the user acceptance of a technology such as HEVs, is the user's intention. Therefore, we hypothesize:

H4: There will become a significant positive relationship between behavioral intention and use behavior of analyze green emission technology acceptance level in automotive industry.

The evidence is facilitating conditions was used to get information about those additional factors, but it is important that consumers can consider as important when buying HEVs, such as the cost of HEV, if adopted HEV is well suited to the lifestyle of the person, so more about the image and status, and also the same no one will have the necessary resources in place to acquire such technology (Divia Riga, 2015). Therefore, we hypothesize:

H5: There will become a significant positive relationship between facilitating conditions and use behavior to analyze green emission technology acceptance level in automotive industry.

RESEARCH METHODOLOGY

This study focused on to explores the relationship between performance expectancy (PE), effort expectancy (EE), social influence (SI), facilitating conditions (FC) towards behavior intention (BI) and use behavior (UB) using UTAUT and to analyze green emission technology acceptance level in the automotive industry. This study will be conducted in Kedah, Malaysia for two weeks. The respondents are 100 students of UUM. In this study, will use the quantitative method in the form of a questionnaire to obtain data and information about green emission technology and to analyze green emission technology acceptance level in the automotive industry. In this study, researchers used a questionnaire to obtain accurate survey results. The first part of the questionnaire is based on demographic information and the second part was designed for a five-point Likert scale UTAUT model question about green emission. Then, five-point Likert scale ranging from one to five describe (1) strongly agree and (2) strongly disagree, (3) neutral, (4) agree and (5) strongly agree. A total of 100 questionnaires were administered and 100 has returned. In selected classes, questionnaires were distributed to researchers and representatives of the class. SPSS Statistical tools are used to capture and analyze data from questionnaires. The data obtained will be processed using program Statistic Package for Social Science (SPSS).

RESEARCH ANALYSIS AND FINDINGS

This section will discuss the result and finding with respect to the variable of the proposed UTAUT such as performance expectancy, effort expectancy, social influence and facilitating condition and their relationship with dependent variable behavioral intention and use behavior.

Descriptive analysis
This questionnaire was completed by 100 students of UUM. The following figure will provide the finding of the analysis general information about the gender, race, age, nationally and level of education. Of these, 80% respondent were female and 20% were male. The following section will describe each group and the finding of the analysis. Refer to Table 1 below for general information.

Table 9

Table 9
General information of UUM students

		Frequency	Percentage (%)
Gender	Male	20	20
	Female	80	80
Age	19-21	28	28
	22-24	70	70
	25 and above	2	2
Race	Malay	82	82
	Indian	4	4
	Chinese	12	12
	Other	2	2
Nationality	Malaysian	98	98
	Indonesia	1	1
	Siamese	1	1
Level of education	Undergraduate	94	94
	Master	6	6
College	CAS	15	15
	COB	77	77
	COLGIS	7	7

Normality test

This table shows all variable are normal caused by variable 'Performance Expectancy have < 0.05 between 0.03 to 0. 05. As shown in table, all variable is <0.015. Refer to Table 2 for more information.

Table 10
Normality test

Variable	Shapiro-Wilk		
	Statistics	df	Sig
Performance Expectancy	.958	99	.0.03
Effort Expectancy	.969	99	.018
Social Influence	.966	99	.012
Facilitating Condition	.966	99	.013
Behavioral Intention	.966	99	.011
Use Behavior	.967	99	.015

Reliability

The finding in table indicates that all variable is reliability except variable social influence and use behavior. The variable is reliability when the reliability statistics are >0.70. Then, the following section present the result for reliability all variable is presented in Table 3.

Table 11

Reliability statistics

Variable	Reliability Statistics
Performance Expectancy	702
Effort Expectancy	780
Social Influence	685
Facilitating Conditions	707
Behavioral Intention	754
Use Behavior	573

Correlation

Table correlation demonstrates the relationship between the variable of UTAUT model. The value of correlation is < 0.05. Performance expectancy contribute 35% to behavioral intention. But, the table show that facilitating condition don't have relationship with performance expectancy. Then, facilitating condition influence use behavior towards the relationship for acceptance green emission in automotive industry. All correlation of coefficient was analyzing on SPSS for each variable and the result of all item correlation are presented in table below.

Table 12

Summary of correlation

		PE	EE	SI	FC	BI	UB
PE	Pearson Correlation	1	.521	.281	.134	.598	.201
	Sig. (2-tailed)		.000	.005	.185	.000	.046
	N	100	99	99	99	99	99
EE	Pearson Correlation		1	.365	.269	.529	.368
	Sig. (2-tailed)			.000	.007	.000	.000
	N		100	100	100	100	100
SI	Pearson Correlation			1	.473	.404	.326
	Sig. (2-tailed)				.000	.000	.000
	N			100	100	100	100
FC	Pearson Correlation				1	.231	.390
	Sig. (2-tailed)					.021	.000
	N				100	100	100
BI	Pearson Correlation					1	.247
	Sig. (2-tailed)						.010
	N					100	100
UB	Pearson Correlation						1
	Sig. (2-tailed)						
	N						100

Table 5 shows the percentage of correlation determination that all correlation contributed. This study pointed behavioral intention has the highest influence on the use behavior by 61 %. Refers table 5 for more details.

Table 13

Correlation of determination

Correlation of coefficient	Correlation of determination %
PE→BI	35%
EE→BI	27%
SI→BI	16%
FC→UB	15%
BI→UB	61%

DISCUSSION

In this study, we explore the relationship between all variable in Unified Theory of Acceptance Use of Technology (UTAUT) for acceptance green emission in automotive industry. Besides that, the result shows that all the variable in UTAUT has a positive influence in order to analyze the green emission technology acceptance level in the automotive industry. This study pointed behavioral intention has the highest influence on the use behavior by 61%. Then, the important factor which caused why consumer does not want to use emission green may be due to tendency constraint to gender. 80 % is a respondent woman while 20% is a man. Apart from that, they also have no powerful influence to use emission green. Thus, price factor of the electric car is expensive is also one of the reasons no user using the green emission. The main problem which caused usage not accepted is due to lack of place recharging the battery for the electric car. The consumer does not want to take a risk and not brave to be trying. Generally, all variable has a positive relationship with performance expectancy. Most of the major manufacturers and some independents developing vehicles that use less (or not) of fossil fuels and emit less pollution. In the transport sector, initiatives have been taken to control emissions from motor vehicles, and to improve the use of energy-efficient vehicles and biofuels. Malaysian Government has gazetted EURO 4M fuel standards in 2013 and authorized its use in RON97 in 2015. A total of 35 depots with blending facilities is constructed in the country to support the implementation of B5 biodiesel program (A mixture of 5% biodiesel in automotive fuel). Implementation B5 program has reduced emissions of GHGs by 1.4 million.

CONCLUSION

The studies are to explores the relationship between performance expectancy (PE), effort expectancy (EE), social influence (SI), facilitating conditions (FC) towards behavior intention (BI) and use behavior (UB) using UTAUT and to analyze green emission technology acceptance level in the automotive industry. The result and the finding show performance expectancy have the positive relationship with all variable in UTAUT. Therefore, a mechanism to reduce emissions, especially in urban areas and reduce the use of vehicles is one of them. However, the increase in population in urban areas, particularly due to the migration is not possible to reduce vehicle can be implemented. Therefore, vehicle manufacturers are now racing to produce vehicles that no longer emit smoke which includes electric and hybrid vehicles. The transition to a new technology that dramatically without looking at the economic impact of a negative impact on all parties, especially the motor vehicle industry and consumers. The process of acceptance of new technologies needs to prefix such a process, testing, regulation

and standards and consumer acceptance. A more important factor is acceptance at all levels and that this new technology should have several advantages over the present. Then, environmentally friendly vehicles are a necessity in the future as conventional vehicles that use ICE using hydrocarbon fuels and cause environmental pollution problems caused by a large number of vehicles on the road. In the future, there is the possibility of all vehicles in the country environmentally friendly but this does not mean all the vehicles using hybrid technology alone.

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