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DRIVING THE FUTURE: UNDESTANDING THE INTENTION TO PURCHASE ELECTRIC VEHICLES OF YOUNG PEOPLE

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ABSTRACT

Car sales increase along with the increasing number of populations. Unfortunately, modern transportation has negative consequences to environment. This situation led world leader to encourage vehicle manufacturers to develop more environmentally vehicle such as electric car that produce less pollution. Jakarta is one on leading market of car in Indonesia can be the main target of the electric car. However, the electric car in Indonesia is categorized an early developed vehicle and the market is very limited. This study examines the intention of young people in Jakarta, Bogor, Depok, Tangerang, and Bekasi to purchase electric car. Technology Acceptance Model (TAM) is applied in this study. The result shows that all variable of TAM has significant contribution to purchase intention. The influence of perceived ease of use to perceived usefulness is significant. This in turns affect to attitude towards using electric vehicle that contributes to the intention to purchase electric vehicle.

Keywords: *Technology Acceptance Model; electric vehicle; car market; intention to purchase, Jabodetabek.*

INTRODUCTION

Mobility is the vital need of modern society (Peters & Dütschke, 2014). Therefore, modern transportation ambitiously developed to meet human need. However, modern transportation that more rely on fossil fuel affects to environmental quality. Hence, the

transition of conventional vehicle to more environmentally vehicle such as electric vehicles (EVs) is prominent to reduce greenhouse gases, air pollution, and dependence on fossil fuels (Lumpur, 2015) so that air quality is improved (Soret et al., 2014; J. Yang et al., 2016). Vehicle electrification also provides some benefits to health (Liang et al., 2019).

Nevertheless, EV adoption is very slow. Some barriers of EVs adoption are because unsure about the EVs performance (She et al., 2017) and consumer perception on EV (Rezvani et al., 2015). Policy approaches are proposed to improve EV adoption such as increasing price of gasoline, decreasing EV price, and developing recharging EVs (Ajanovic & Haas, 2016; Shafiei et al., 2012; Yang, 2010), or even creating technology for reducing electricity consumption of car and provide a guarantee for availability of electricity (Xiao et al., 2020).

On the other hand, some scholars using individual approaches. Hedonic attributes, symbolic attributes, and instrumental attributes has significant contribution to EVs adoption (Liu et al., 2021; Schuitema et al., 2013; White & Sintov, 2017). Psychological and demographic characteristic also proven have influence to EVs adoption (White & Sintov, 2017). Peters and Dütschke, (2014) implemented relative advantages, compatibility, ease of use, trialability, observability, and social norm to investigate the determinant of intention to buy and use EV. Meanwhile, Sang and Bekhet (2015) proposed new model of EV acceptance in Malaysia by involving seven factors, i.e. environmental concern, performance attribute, social influence, financial benefits, demography, infrastructure readiness, and government intervention. Study in Dundee and Newcastle Upon Tyne conducted by Morton et al. (2016) have proven that attitude concerning the performance of EV and consumer innovativeness are two influential variables of EV preference. Han et al. (2017) concern on functional values (i.e. monetary, performance, and convenience values) and non-functional values (i.e. emotional, social, and epistemic values) as the determinant of EV adoption. Price values in addition to environmental performance and range confidence that influence the attitude toward EV which in turns affect to purchase intention is also investigated by Degirmenci and Breitner (2017). By using discrete choice Huang and Qian, (2018) have conducted study on the influence of monetary attribute in addition to other variables such as service attribute, driving range and psychological factors on consumer preference for EV. The adoption of EV is related to people who aware to environmental issue and open to new technology (Haustein & Jensen, 2018). Yang and Chen (2021) using discrete choice for identifying the preference of society to adopt EV in terms of knowledge, personality, social influence, socio-demographic factors, and attributes of EV. A review of literatures have been conducted by Coffman et al. (2017) shows that charging infrastructure and networks are

some of influence factor of EV adoption in addition to fuel price, consumer characteristics, social norms, policy mechanism, and awareness.

Some others implemented behavioural theory to identify EVs intention and adoption. Theory of Planned Behaviour (TPB) (Haustein & Jensen, 2018; Liu et al., 2020; Wang et al., 2014), Unified Theory of Acceptance and Use of Technology (UTAUT) (Preston, 2016), Theory of Action Research (TRA) (Lumpur, 2015) are some consumer behaviour theories that were applied to identify the determinant of EV intention and adoption. The theory of Technology of Acceptance Model (TAM) also one of theory applied for identifying human behavior related to EVs.

Some researchers have applied TAM for measuring the intention and actual adoption of EVs. Globisch et al. (2018) shows that PEU influences PU that contributes to EVs acquisition. Müller (2019) has made evidence that there is significant influence of PEU and PU to ATU, as well as ATU to PI. Using the extension of TAM, Dudenhöffer (2013) was unable to proven that PEU and PU influence purchase intention. Meanwhile, Plötz et al. (2014) shows that the attitude toward EVs adoption of people with low EV affinity is small, whilst people with high EV affinity has good attitude toward EVs adoption.

By 2009, car ownership in Indonesia was about 17 million cars, whilst 4 million of them distributed in DKI Jakarta (BPS, 2020). At the time being, the number of population in DKI Jakarta was 10.5 million people (BPS, 2020). Thus, it was 40.5% of population in Jakarta had car. The number of car demand in Indonesia during January-June 2022 was the highest among ASEAN countries (GAIKINDO, 2022). Moreover, car sales increase over the time. By June 2022, it was recorded that the car sales increase about 60.08% (Prakoso, 2022). This could be market potential for car sales in Indonesia. Even, the issue of car electrification encourages the car sales in Indonesia (Sari, 2022). Therefore, this study aims to investigate the intention of Jabodetabek's society to buy electric vehicle by implementing TAM's framework.

LITERATURE REVIEW

Technological Acceptance Model

Technology acceptance Model (TAM) was found by Fred Davis in 1985. TAM was originally the developed based on Theory of Reasoned Action (TRA) (Masrom, 2007). This model was initially developed to improve information technology (IT) acceptance (Holden & Karsh, 2010) and have widely implemented in information Technology (IT) (Lee et al., 2003). Nowadays, TAM is popular model for predicting human behavior to accept technology (Marangunić & Granić, 2015) because this model is empirically proven have

high validity (Chau, 1996). Therefore, this model is widely use to predict the system use (Chuttur, 2009).

The first version of TAM consists of five variables i.e. perceived usefulness (PU), perceived ease of use (PEU), attitude toward using (ATU), purchase intention (PI), and actual use (AU). Perceived of ease of use (PEU) is measure the perception of people in using technology is free of effort. Davis (1989) defines PEU as the degree to which a person believes that using particular system would be free of effort. It sometimes refers to effortless in using the technology (Masrom, 2007). This is a subjective assessment (Thilina & Gunawardane, 2019). Meanwhile, perceived usefulness is defined by Davis (1989) as the degree to which a person believes that using a particular system would enhance his or her job performance. Attitude toward using is individual judgement about the technology. It is commonly measured good/bad, harmfull/beneficial, present/unpleasant (Holden & Karsh, 2010).

Hypothesis Development

This study using original TAM model without actual use. Actual use is removed from the model because EVs have not yet implemented by the government that led the population of electric vehicle owner in Indonesia is very small. The model of this study is presented in Fig. 1.

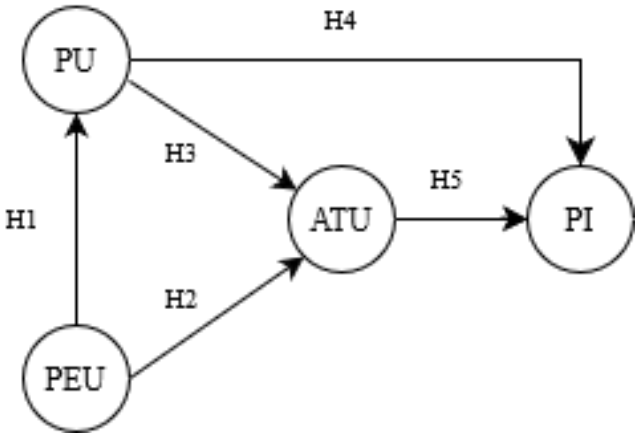

Fig. 2. Model of this study

Study on EVs by using TAM framework has been implemented by many researchers. Dudenhöffer (2013) study shows that PEU and PU did not have influence to purchase intention, but PEU influence PU. However, Ambak et al. (2016) and Müller (2019) shows that relation among PEU, PU, ATU and purchase intention is significant. He also found

that the influence of ATU to PI is significant as well. Attitude toward using EV influence the intention to use EV has been studied by researchers (Degirmenci & Breitner, 2017; Rezvani et al., 2015). Lumpur (2015) measures attitude through individual and environmental consequences that indicated by convenience, range of product sizes and perceived of usefulness. Using TPB framework, attitude along with subjective norm influence the adoption (Li et al., 2020; Wang et al., 2016). However, using experimental study, Jensen et al. (2013) proven that attitude did not influence the preference to use EV. Due to these research gaps, hence the hypotheses of this study are:

H1: Perceived ease of use of EVs influences perceived usefulness of EVs

H2: Perceived ease of use of EVs influences attitude toward using EVs

H3: Perceived usefulness of EVs influences attitude toward using EVs

H4: Perceived usefulness of EVs influences purchase intention of EVs

H5: Attitude toward using EVs influences purchase intention of EVs

Since the model in Figure 2 is a structural model, it is important to investigate some mediation variable in the model such as perceived usefulness as the mediation of perceived ease of use and attitude, and attitude toward using as the mediation between perceived ease of use and purchase intention as well as perceived usefulness to purchase intention. Therefore, the hypotheses are:

H6: Perceived ease of use influences attitude towards using EVs by mediating with perceived usefulness

H7: Perceived ease of use influences purchase intention of EVs by mediating with perceived usefulness

H8: Perceived ease of use influences purchase intention of EVs by mediating with attitude towards using EVs

H9: Perceived usefulness influences purchase intention of EVs by mediating with attitude towards using EVs

H10: Perceived ease of use influences purchase intention of EVs by mediating with perceived usefulness and attitude towards using Evs

RESEARCH METHOD

This study is an online survey to society in Jakarta, Bogor, Depok, Tangerang and Bekasi (Jabodetabek) society. This area is selected because Jakarta is one of the most prominent car markets in Indonesia. The survey was conducted during 28th of March to 17th of April 2022. The respondents were the society who aged between 18 years old to 55 years old. The number of respondents was 100 respondents. This number is selected based on Levy and Lemeshow (2008) formula. By using 10% of sampling error (α) and 95% of confidence interval, the number of respondents we should take is at least 96,04.

Two variables exogenous and two variables endogenous are applied in this study. Perceived ease of use (PEU) and perceived of usefulness (PU) are exogenous variables, whilst, attitude towards using (ATU) and purchase intention (PI) are endogenous variables. Each variable is measured by using Likert scale from 1 to 5, where 1 is totally disagree, 2 is disagree, 3 is neutral, 4 is agree, and 5 is totally agree. Perceived usefulness is measured by six questions that represents four indicators which is implemented by Udayana and Ramadhan (2019), i.e. effectiveness, usefulness, productivity, and improve the performance. Perceived ease of use using six questions that represents six indicators provided by (Davis, 1989). Those indicators are ease to be learnt, ease to achieve the goal, ease to be understood, flexible, free of difficult, and ease of use. Attitude towards behavior variable follows Udayana and Ramadhan (2019). Intention behavior is measured by using four indicators, i.e., transactional intention, referential intention, preferential intention, and explorative intention (Davis, 1989).

The assessment of quality data applied validity and reliability test. Discriminant validity by using cross loading factors is applied. Data analysis for this study is Partial Least Square (PLS). This method is applied because it is suitable for small data of structural model. The calculation is processed by using Smart PLS 3.0.

The decision of mediation effect follows Wang et al. (2016). Full mediation is when independent variable is not significantly affected by dependent variable, but mediation variable is significantly affected by independent variable and the independent variable is significantly affected by mediation variable. However, if the independent variable influences mediation variable and mediation variable influences dependent variable is called as partial mediation.

Goodness of Fit (GoF) of the model is measured by using R^2, R^2-adj, AIC, BIC, and HQ. Meanwhile, the model fits using Standardized Root Mean Square Residual (SRMR), Chi-square, and Norm Fit Index (NFI). SRMR value less than 0.1 or 0.08 is viewed as good fit (Hu & Bentler, 1999), Chi-Square and NFI close to 1 is better fit (Bentler & Bonett, 1980).

DATA ANALYSIS AND DISCUSSIONS

Respondent Profile

This study is an online-distributed survey to Jabodetabek society. According to Table 1, most of respondent were female (59%). Moreover, more than half of respondent (53%) were in age group of 18-24 years old, whilst a quarter of them were in age group of 41-55 years old. About 37% of respondents who were involved in this study were school/university students and 30% of respondents were a private company employee. This study also shows that around 37% of respondents were having salary more than five million IDR, but 28% of respondents did not want their salary to be recorded. All of respondents were distributed in 14 districts in Jabodetabek. Most of them from Bekasi (15%), Depok (13%), and South Jakarta (12%).

Table 1. Respondent profile

Variable	Category	Percentage (%)
Gender	Male	41
	Female	59
Age	18-24 y.o	53
	25-40 y.o	22
	41-55 y.o	25
Occupation	School and university students	37
	Private company employee	30
	Entrepreneur	11
	Teacher/lecturer	7
	Government official	4
	Housewife	5
	Others	6
Salary	Less than 1 million IDR	6
	1 million – 5 million	29
	More than 5 million	37
	Idle	28

Data Analysis

PLS analysis using SmartPLS is revealed in Figure 2. The figure contains of validity test of each construct, direct effect parameters, and R^2 of the relationship. The Figure 2 is, then, breaking down in to Table 2, Table 3, and Table 4. Table 2 presents the validity and reliability data. Table 3 reveals parameters of model. Table 4 shows the R^2.

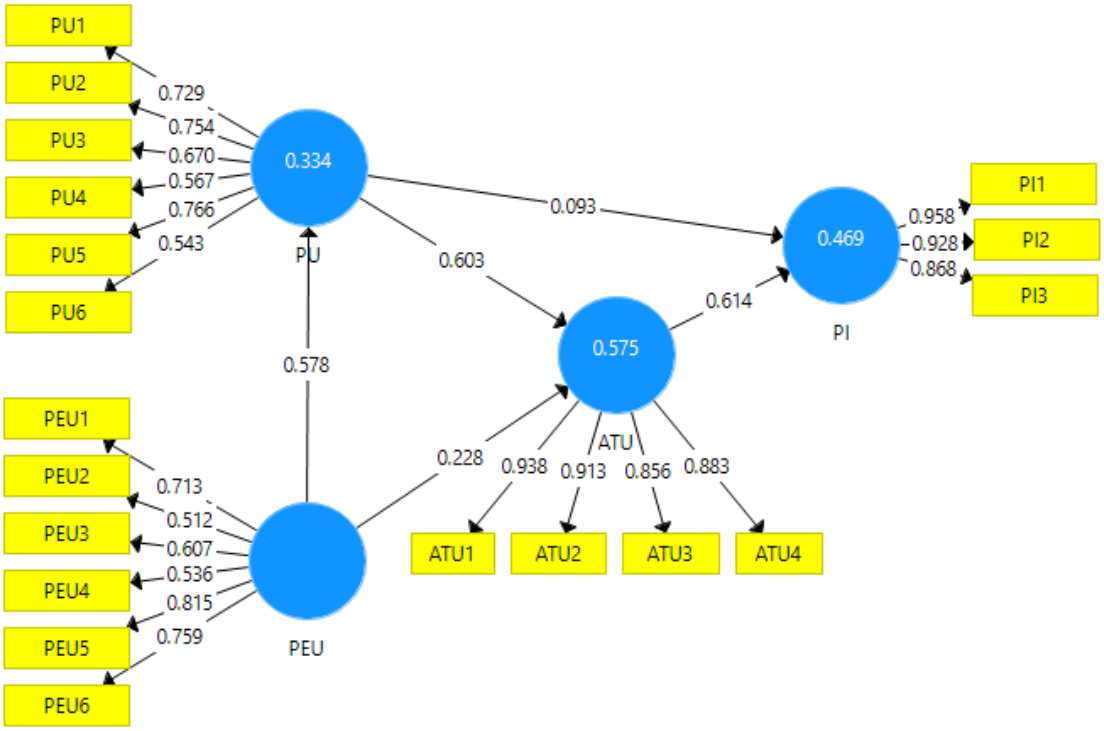

Figure 2. Result of PLS analysis of the model using SmartPLS software

To investigate the quality of data, validity and reliability test is implemented in this study. Loading factor is applied for validity test, whilst Cronbach's alpha, Rho, and Composite reliability are applied for construct reliability tests. The result of validity test from SmartPLS software which is summarized in Table 2 show that the Loading Factor of constructs are ranged from 0.512-0.958. Hair Jr et al. (2014) says that the validity test between 0.5 and 0.6 is considered as moderate, whilst 0.7 or above is high. The cross loading of PU3, PU4, PU6, PEU2, PEU3, and PEU4 are 0.5 and 0.6. Those values imply that the validity of those constructs is moderate. On the other hand, the rest of constructs are categorized as high validity. Table 2 also reveals that Cronbach's alpha, Rho, CR method of all variables are reliable since the values are more than 0.7.

Table 2. Loading factors and validity of construct

Variable	Question	Cross Loading	Reliability		
			Cronbach's alpha	Rho	Composite reliability
Perceived usefulness	PU1	0.729	0.760	0.784	0.833
	PU2	0.754			
	PU3	0.670			
	PU4	0.567			
	PU5	0.766			
	PU6	0.543			
Perceived ease of use (PEU)	PEU1	0.713	0.740	0.762	0.823
	PEU2	0.512			
	PEU3	0.607			
	PEU4	0.536			
	PEU5	0.815			
	PEU6	0.759			
Attitude Toward using	ATU1	0.938	0.920	0.924	0.943
	ATU2	0.913			
	ATU3	0.856			
	ATU4	0.883			
Purchase intention	PI1	0.958	0.907	0.924	0.943
	PI2	0.928			
	PI3	0.868			

Table 3 provides parameters of direct and indirect effect of model, whilst Table 4 provides R2 of model. Five hypotheses assessed the direct effect between variables. Those are the influence of perceived ease of use to perceived usefulness (PEU → PU), perceived ease of use to attitude toward using (PEU → ATU), perceived usefulness to attitude toward using (PU → ATU), perceived usefulness to purchase intention (PU → PI), and attitude toward using to purchase intention (ATU → PI). All p-values of parameter of all direct effects show significant at α = 5% except the influence of perceived usefulness to purchase intention (PU → PI) that have p-value 0.398 which is more than α = 5%.

Table 3. The parameter of models

Hypothesis		Parameter	*p*-value
Direct effect	PEU → PU	0.578	0.000
	PEU → ATU	0.228	0.006
	PU → ATU	0.603	0.000
	PU → PI	0.093	0.398
	ATU → PI	0.614	0.000
Specific indirect effect	PU → ATU → PI	0.370	0.000
	PEU → ATU → PI	0.140	0.017
	PEU → PU → ATU	0.349	0.000
	PEU → PU → PI	0.054	0.436
	PEU → PU → ATU → PI	0.237	0.000

This study proven that perceived ease of use of EVs has a significant influence to perceived usefulness of EVs (PEU → PU) and attitude toward using EVs (PEU → ATU). The influence of perceived ease of use to perceived usefulness is higher (0.577) than it affects to attitude toward using EVs (0.229). This indicates that perceived ease of use has more contribution to determine perceived of usefulness of EVs than attitude toward using EVS. Later, perceived of usefulness have significant influence on attitude toward using EVs (PU → ATU) with the parameters of 0.603. Furthermore, attitude toward using EVs affects purchase intention (ATU → PI) with parameter of 0.682. This is the highest direct relationship in this model. However, this study shows that the influence of perceived usefulness to purchase intention (PU → PI) is not significant.

The model in the study is not merely investigate the direct relationship between variables, but it also examines the in direct effect. Five direct effects are measured in this study with two variables as the mediator variables, i.e. perceived usefulness of EVs and attitude toward using EVs. All of hypotheses of mediation variable are revealed in Table 3. The p-value of analysis of mediator effects show that all indirect effects are significant at α = 5%, except the relation of perceived ease of use to purchase intention with perceived usefulness as the mediation variable (PEU → PU → PI).

The indirect effect of perceived usefulness and purchase intention through attitude toward using (PU → ATU → PI) as the mediation variable has the highest effect (0.370). The influence of perceived ease of use to purchase intention through attitude toward using EVs (PEU → ATU → PI) is significant (p-value = 0), but the influence of perceived ease of use to purchase intention mediated by perceived usefulness (PEU → PU → PI) is not significant (p-value = 0.436). This is because the direct effect of perceived

usefulness and purchase intention is not significant as well. Moreover, the relation of perceived ease of use to attitude toward using EVs that mediated by perceived usefulness (PEU → PU → ATU) is higher than the relationship of perceived ease of use to purchase intention mediated by attitude towards using EVs (PEU → ATU → PI). Interestingly, the relationship among perceived ease of use to purchase intention that mediated by perceived usefulness attitude toward using EVs (PEU → PU → ATU → PI) is significant with the parameter is 0.237.

This study shows that not all direct and indirect effect are significants. The relation of perceived usefulness to purchase intention is not significant. However, when the attitude toward using EVs given to the relation as mediation variable, the relation is significant. This means, attitude can be the fully mediator of relation between perceived usefulness and purchase intention.

Insignificant relation also occurs for the relation among perceived ease of use to purchase intention that is mediated by perceived usefulness. On the other hand, when attitude toward using EVs is involved in that model as the mediator of perceived usefulness and purchase intention, the relation is significant. This result implies that attitude toward using EVs plays as fully mediator of perceived usefulness and purchase intention. But, the role of perceived usefulness is partially mediator between perceived ease of use and attitude toward using EVs.

The Goodness of Fits (GoF) of model are measured by using R^2, R^2-adj, AIC, BIC, and HQ. The higher R^2 and R^2-adj are the better GoF, whilst the smaller AIC, BIC, and HQ are the better GoF. The calculation of those measurements gathered from Smart-PLS is presented in Table 4. The R^2 of the relationship between PEU and PU is 33.4%, among PEU, PU, and ATU is 57.5%, and among PEU, PU, ATU, and PI is 46.9%. The relation among PEU, PU, and ATU is the highest. This means that the contribution of PEU and PE to determine ATU is 57.5%. All of the measurements show that attitude towards using as endogenous variable which is influences by perceived usefulness and perceived ease of use as exogenous variable (PEU, PU, ATU) has better GoF in comparison to perceived usefulness and purchase intention as exogenous variable. This indicates that there is strong relation among perceived usefulness and perceived ease of use that influence attitude toward using EVs.

Meanwhile, the model fits using SRMR and NFI. The value of SRMR and NFI are 0.095, and 0.716, respectively. The model is categorized as fit if the SRMR is less than 0.1 and NFI is close to 1. Using these criteria, it can be concluded that the model fits.

Discussion

Perceived ease of use in this study contains of the ease to drive, the feature to connecting car with gadget, electricity for fueling the car is easy to be found, and ease for maintenance. Perceived usefulness in measured from the benefit of electric car for human mobility, reduce air and sound pollution, increase social prestige, drive long distance, and improve mobility effectiveness. Some researchers implement two type of perceived usefulness, i.e. near term usefulness and long-term usefulness (Chau, 1996). Meanwhile attitude toward using is measured by good idea, wise idea, enjoyment.

The direct effect of perceived usefulness to purchase intention in this study does not prove. This result support revised TAM developed by Davis (1989). Initially, he proposed original model like as presented in Figure 1. But he made a revision by removing the direct effect of perceived usefulness to purchase intention because it is suitable to pre-implementation of the technology (Szajna, 1996). Since the EVs is not popular and limited people adopt it in Indonesia, revised model TAM is more suitable for this study. This is also proven by the result of this study that perceived usefulness does not affect to purchase intention.

The influence of perceived ease of use to perceived usefulness in this study is higher than the influence of perceived ease of use to attitude toward using EVs. This is in contrast to Ambak et al., (2016) result. Moreover, the relation of perceived ease of use to attitude toward using EVs with perceived usefulness as mediator is higher than the relation between perceived ease of use to attitude towards using EVs. This means that perceived usefulness is essential in mediating perceived ease of use to attitude.

Using TAM model, this study shows R^2 is 46.9%. Previously Ambak et al. (2016) study shows 52.6% and Yousif and Alsamydai (2019) got 17.2%. This implies that the relationship among perceived ease of use, perceived usefulness, attitude toward using EVs, and behavior intention in this study is not very strong. Therefore, modify of the models by adding some variables is needed.

CONCLUSIONS AND SUGGESTIONS

Even though some researchers are skeptic to TAM (Chuttur, 2009), this study have proven that the model is significant. This result indicates that the role of perceived ease of use, perceived usefulness, and attitude toward using EVs is substantial in determining the intention to purchase EVs. The result of this study provides valuable insight in enriching the implementation of TAM in technology acceptance, especially for electric vehicle acceptance. Almost all model hypotheses are significant except the direct effect

of perceived usefulness to purchase intention. Perceived usefulness also failed to mediate perceived ease of use and purchase intention. However, this model shows that attitude toward using EVs plays as fully mediators between perceived usefulness and purchase intention, as well as perceived ease of use and purchase intention. Thus, it is important for EVs to pay more attention on attitude towards using EVs because it is essential in determining the purchase intention of EVs. However, intention can't represent the actual use. Thus, expanding the model to actual use can be the future study. Moreover, respondent of this study is mostly dominated by people who do not have experience in using electric car. They may have different attitude toward electric car after using it. In addition, this study applies original TAM model that provide R^2 of 46.9%. The extended TAM by adding some variables such as price, electricity supply, or availability and reliability of battery could be applied to enhance the R^2.

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