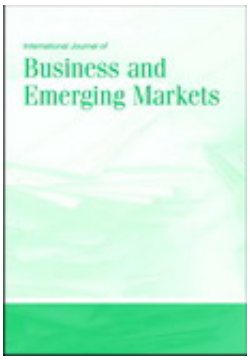

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Does environmental awareness play a mediating role in electric vehicle purchase intention? A perspective from the theory of consumption values and technology acceptance model

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Does environmental awareness play a mediating role in electric vehicle purchase intention? A perspective from the theory of consumption values and technology acceptance model

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Abstract: In view of increasing carbon emissions and climate change concerns around the globe, the 'go green' transition from petrol-powered vehicles to electric vehicles is one of the sustainable ways forward. This study therefore sought to explore Malaysian consumers' electric vehicle purchase intent by applying the theory of consumption values and the technology acceptance model. This study also leveraged the impact of government intervention on attitude and the mediating influence of environmental awareness on the association between attitude and purchase intention. A self-administered questionnaire was employed to collect data from Malaysian consumers. The results showed a substantial positive impact of attitude on electric vehicle purchase intention, which was found to be mediated by environmental awareness. Consumption values and perceived usefulness were also discovered

to have a significant effect on attitude, while government intervention indicated no such effect. The findings offer meaningful insights and practical implications in building a greener community.

Keywords: electric vehicle; purchase intention; theory of consumption values; TCV; technology acceptance model; TAM; environmental awareness; government intervention.

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1 Introduction

Given how environmental degradation has affected developed countries' policies and economy, 'going green' appears to be the approach to advance towards a sustainable world (Gazzola et al., 2019). Environmental degradation is caused not only by the industry but also by consumers' consumption patterns and purchasing behaviour, as in the case of microfibre pollution due to the over-demand of polyester-based clothes (Technon OribChem, 2014). Therefore, consumers should also take responsibility for environmental issues and make changes such as consuming green products (Teoh and

Mohd Noor, 2015). In fact, significant awareness of green products among consumers can decrease environmental threats while creating more opportunities for businesses and boosting the economy.

Malaysia is one of the biggest and most well-built automobile markets in the ASEAN region, evidenced by the projection that Malaysians will perform 131 million daily trips by car by 2030 (Department of Statistics Malaysia, 2020). However, Malaysia has just begun taking baby steps towards preserving the environment as a developing country (Ramayah et al., 2010). With total car ownership reaching about 28.3 million on-the-road units, carbon dioxide (CO2) emission levels grow up to 250.3 million tonnes per year (Lee, 2017). According to the International Energy Agency (IEA), CO_2 is a large contributor to climate change, which calls for the automotive industry to take serious efforts to improve the efficiency of vehicles' energy usage by reducing fuel combustion emissions (IEA, 2019). In this regard, the electric vehicle (EV) is the representative of the green product category in the automotive industry (Teoh and Mohd Noor, 2015). Since Malaysia aims to decrease CO_2 emissions per unit of gross domestic product (GDP) by 45% before 2030, the adoption of EVs is now seen as a positive move and a feasible alternative for lower emissions (Khoo, 2019).

Despite this realistic and achievable solution, Malaysia is still in the early stage of EV adoption, lagging behind developed countries due to citizens' lower technology acceptance rate (Khalili, 2019). Furthermore, due to the lack of intervention from the government, infrastructures and facilities for EVs are not easily accessible in the country (Alghoul et al., 2018; Lopes et al., 2019). This is because national carmakers enjoy government protection, which is deteriorating the growth of the automotive industry in Malaysia (Abllah, 2018). As mentioned by the Malaysian International Commerce and Industry (MICCI), removing protectionism in the Malaysian local auto sector would bring greater transparency and drive manufacturers to plan their product mix and offerings by studying the market (Gilbert, 2021). The government must therefore look into its policies and town planning to provide EV charging facilities across the country to boost Malaysia as an electric-efficient vehicle hub in the region (Vong, 2022). Ultimately, it is essential and relevant to examine Malaysian consumers' EV purchase intention, especially in terms of their acceptance level towards EVs.

Previous studies have mainly employed the theory of consumption values (TCV) as the core structure to explore the major factors of consumer purchasing intention (i.e., Chakraborty and Paul, 2022; Chakraborty et al., 2022; Han et al., 2017; Zailani et al., 2019). Meanwhile, scholars like Jayaraman et al. (2018), Tanwir and Hamzah (2020), Yan et al. (2019) and Dzung et al. (2021) utilised the theory of planned behaviour (TPB) to discover predictors of consumers' purchasing or adopting intention. Considerable studies have also combined constructs, such as perceived usefulness (PU), perceived ease of use (PEOU), environmental awareness (EA), and government intervention (GI), in studying purchase intention. However, Sniehotta et al. (2014) highlighted that the TPB's proposals are flagrantly untrue, as the intermediation norms in the TPB conflict with evidence. The TPB also does not take environmental or economic factors into account in predicting individual behaviour. It further neglects the factor of time, assuming behaviour to be the consequence of a linear decision-making progression (LaMorte, 2019). Therefore, this study merged the TCV and the technology acceptance model (TAM) by incorporating additional variables to explore consumers' purchase intention towards EVs in Malaysia. Notably, EA was positioned as a mediator that explains the connection between consumers' attitude towards EVs and their purchase intent of EVs.

2 Literature review

2.1 EV industry in Malaysia

The government plays a crucial role in reducing CO_2 emissions effectively in the transportation sector by implementing relevant policies and incentives (Mustapa and Bekhet, 2016). In this regard, EVs are a promising option to accomplish the long-term goal of minimising harmful emissions in the country. However, Malaysia is still relatively new in adopting EVs. The country is still highly dependent on fossil fuel for transportation activities, leading to the high consumption of fuel as well as the continuous contribution to CO_2 emissions.

In addition, the government is still tinkering with its EV policy, leaving the country far behind regional competitors like Thailand and Indonesia that have attracted huge foreign direct investments from global EV manufacturers and companies involved in EV-related technologies (e.g., energy storage systems, lithium-ion batteries) (Azhar, 2021). In particular, the Malaysian government's National Automotive Policy 2020 has been criticised by many global players for being too general and lacking specific initiatives. In comparison, Thailand's Board of Investment approved a 3.2 billion Thai Baht investment by Auto Alliance (Thailand) Co Ltd in November 2019 to produce 5000 plug-in hybrid EVs and 1,000 battery EVs.

In Malaysia, the EV industry is mainly dominated by premium brands such as Bayerische Motoren Werke (BMW) and Mini, which sold nearly 3,000 EVs in 2019 (Yunus, 2020). These EVs are rather expensive, costing well above RM200,000. Even the lowest priced EV in Malaysia, the Nissan Leaf, costs a hefty RM181,000, which is not exactly affordable (Shah, 2021). Limited charging stations across the country is another reason EVs are not common in Malaysia. At present, there are only about 509 public charging stations across the country (Nair, 2021). In comparison, the Netherlands – which has widely adopted EVs – has a network of more than 75,000 charging stations across the country, making up nearly one third of the entire European Union's stations (French Press Agency, 2021).

2.2 EV purchase intention

Purchase intention is "the plan and eagerness of a consumer to purchase a certain good or service in the future" (Wu et al., 2011b). According to Wu et al. (2011a), purchase intention refers to customers' focus on purchasing a product and their subsequent likelihood of purchasing it. This concept reveals consumers' implicit view of price and quality when making a purchase choice (Dodds et al., 1991). In the context of automobiles, factors like PU, PEOU, GI, and EA are found to influence consumers' purchase intention, as consumers place different values on a product (Ramkissoon et al., 2009). It has indeed been proven that consumption values affect the purchase intention of consumers (Teoh and Mohd Noor, 2015).

Prior studies have examined purchase intention in the EV context. For instance, scholars have considered consumer responses to initiatives to reduce global gas emissions by purchasing hybrid vehicles (Bhutto et al., 2020) as well as the effects of product sales, product type, and experience sharing with friends and family (Cronin et al., 2000; Varshneya and Das, 2016). Correspondingly, this study investigated multiple factors affecting Malaysian consumers' intention to purchase EVs via the mediating impact of

EA. This knowledge would allow EV manufacturers and marketers to understand current market trends and accordingly make the right decisions in terms of production planning (Yeo et al., 2016).

2.3 Technology acceptance model

The TAM, pioneered by Davis (1989), recognises users' acceptance of new technologies and plays a vital role in identifying behavioural predictors of consumers' possible approval or refusal of a new technology (Marangunić and Granić, 2014).

The TAM was developed on the foundation of the TPB and the theory of reasoned action (TRA) (Müller, 2019). Fishbein and Ajzen's (1975) TRA identifies the causal connections between components such as attitude, intention, belief, and behaviour to explain one's actions. It states that one's behaviour is established by his/her thought with regard to the behaviour and the subjective norm (i.e., social pressure) to act on the behaviour. Ajzen then brought over the main idea of the TRA to the TPB (Ajzen, 1985, 1989), wherein the concept of perceived behavioural control was incorporated as an objective antecedent of behaviour, independent of perceived outcomes (Gong and Yan, 2004). To foresee a person's attitude with respect to utilising a technology and his/her objective to use it, the TAM highlights the important roles of PEOU and PU in technology acceptance. The TAM has been used in diverse contexts, such as online food ordering (Salunkhe and Petkar, 2018; Sethu and Saini, 2016), shared ride-hailing service (Goel and Haldar, 2020), self-driving cars, and EVs (Ambak et al., 2016; Müller, 2019). This study thus incorporated the TAM to understand consumers' intention to purchase EVs, which reflects their acceptance level of this new technology.

2.4 Perceived ease of use

Davis (1989, 1993) stated that PEOU is a person's view that the usage of a new technology will be effortless. In other words, it refers to how easy one believes it is to use the technology (Ma et al., 2017). PEOU has been examined extensively in research on decisions to learn a computer language based on one's own capacity and after-effect beliefs (Hill et al., 1982). Davis (1989) proposed that PEOU is an influential antecedent of users' attitude. Consistent with this, preceding studies have proven that PEOU is the most dominant predictor of attitude (Ambak et al., 2016; Ma et al., 2017; Müller, 2019). Moreover, PEOU is suggested to have a positive impact on PU (Davis, 1989). Validating this notion, Raksadigiri and Wahyuni (2020) and Setiawan et al. (2018) found a significant link between PEOU and PU. If consumers think a product is simple to use, they are expected to perceive its functionality in a better light and form a positive attitude towards using it. Notably, according to Müller (2019), PEOU increases both the PU of EVs and the attitude towards using EVs in North America. Therefore, the following hypothesis was formulated:

H1 PEOU has a positive and significant influence on the attitude towards EVs.

H2 PEOU has a positive and significant influence on the PU of EVs.

2.5 Perceived usefulness

PU is defined as "a person's discernment that the usage of a new technology will bring improvement or enhancement to his/her execution" (Davis, 1989, 1993). In simpler terms, PU expresses the level to which consumers believe in the usefulness of a technology. Therefore, users' conviction that they can enhance their job performance by using a specific application or system can be referred to as PU.

Moreover, PU and attitude are not required to hold or constitute motivations to act in any specific situation or for any particular decision maker (Bagozzi, 2007). Previous research has recognised that PU has a positive considerable impact on attitude in the context of EVs (Müller, 2019), e-hailing services (Goel and Haldar, 2020), apparels (Ma et al., 2017), social media (Setiawan et al., 2018), and online purchasing (Renny et al., 2013). Overall, the evidence suggests that consumers who appreciate the functions of a product will have a positive inclination towards using the product. For that reason, the following hypothesis was formulated:

H3 PU has a positive and significant influence on the attitude towards EVs.

2.6 Theory of consumption values

Introduced by Sheth, Newman, and Gross in the early 1990s (Teoh and Mohd Noor, 2015), the TCV is a theory that illustrates consumers' decision-making behaviour in purchasing a specific product. The TCV can be applied to a wide variety of product types, such as industrial commodities and services with durable and non-durable consumption goods. In the automobile context, the TCV posits five consumption values, i.e., functional, conditional, social, emotional, and epistemic (Sheth et al., 1991), that each play a distinct function in driving a consumer's decision to purchase EVs (Deng et al., 2010). Indeed, the TCV has been used to forecast consumers' intent to purchase hybrid cars (Teoh and Mohd Noor, 2015).

Perceived value is not restricted to practical facets such as quality and price (Sheth et al., 1991). Rather, it represents a consumer's general assessment of the satisfaction obtained from products and services (Patterson and Spreng, 1997). Companies that offer different product benefits can thus create a competitive advantage (Zeithaml, 1988). Numerous studies in the automotive context have used the TCV as their main theoretical framework. However, the outcomes of these studies focused on the purchase intention of hybrid cars and petrol-powered automobiles (Han et al., 2017; Jiang, 2016; Teoh and Mohd Noor, 2015), as well as the willingness to pay for biofuels (Zailani et al., 2019). To extend its applicability, the TCV was deployed in this study to explain the purchase intent of consumers in relation to EVs.

2.7 Consumption values

In consumers' decision-making process, value is a prominent consideration (Sweeney and Soutar, 2001). Perceived value refers to consumers' give-and-take between gained benefits and sacrificed quality/cost during an exchange (Gallarza and Gil, 2008). The TCV explains how consumers make decisions when given such choices by postulating that consumer behaviour is impelled by five main consumption values: 'functional value' (FV), 'conditional value' (CV), 'social value' (SV), 'emotional value' (EM), and

'epistemic value' (EP). Consumer decisions can be impacted by one or the other or all of these consumption values (Sheth et al., 1991). For instance, the study by Abdullah et al. (2019) investigated the responsible environmental behaviour of travellers using the components of environmental consumption value. Alternatively, the consumption values were viewed as a whole to examine consumers' attitude towards EVs in this study.

First, FV is a fundamental driver of consumer preference. It is described as "the observed utility obtained from a product or service's perceived quality, physical performance, excellence, and superiority in meeting consumers' functional needs" (Delassus and Descotes, 2012; Kim et al., 2011). Consumers tend to aim for products that have value for money and quality that justifies their price. For instance, FV has been employed to determine consumers' enthusiasm to pay for biofuels (Zailani et al., 2019). In that case, the fuels' price, maintenance, and performance must meet the expectations of consumers to increase their purchase intention. For EVs, the functionality, utility, or advantages that can be obtained from the features of an EV represent its FV (Han et al., 2017).

Second, CV is the satisfaction generated when one follows situational influences in making a decision (Sheth et al., 1991). Comparably, it is the gratification aroused from a unique condition during decision-making (Gonçalves et al., 2016). CV affects the purchase intention of consumers in specific scenarios such as value-added situations, subsidy situations, and time-saving situations. For instance, CV has been uncovered to have a significant influence on purchase intent towards green products, mainly due to the condition of global warming and environmental threats (Lin et al., 2010). Therefore, if the government implements subsidy policies for the purchase of EVs, the competitiveness of EVs would be enhanced compared to petrol-powered vehicles, which would consequently enhance consumers' purchase intention towards EVs. This is because consumers consider the threatened planet when choosing this product, aiming to minimise damage to the environment under those circumstances.

Third, SV is the social well-being attained when a person purchases a product that is associated with his/her social group(s), abilities, social interests, cultural values, or societal norms (Kenter et al., 2015; Kim et al., 2011). A product's capacity to maintain one's social self-image in this manner leads to satisfaction and can be classified as SV (Sweeney and Soutar, 2001). Therefore, social factors such as family, friends, community, media, and advertisements can impact the purchase intention of an individual (Sulastri et al., 2017). In fact, SV is known to play a crucial part in shaping consumers' purchase intent towards luxury products such as cosmetics (Ajitha and Sivakumar, 2017; Cuomo et al., 2019). In the current instance, the brand impression of EVs may increase consumers' intention to purchase it to enhance their self-image (Kim et al., 2011). For example, purchasing Tesla's EV would create an image of being environmentally friendly and luxurious in one's social circles.

Fourth, EM represents the satisfying emotions, feelings, or affective states generated from purchasing or experiencing a product (Asshidin et al., 2016; Candan et al., 2013). EM is created by the consumer's experience of consuming goods and services (Sierra and McQuity, 2005), whereby greater levels of experience can cultivate feelings of desire, awe, and contentment attributed to a brand. A previous study has shown that EM can affect consumers' purchase intention towards hybrid cars (Teoh and Mohd Noor, 2015). Similarly, Yu and Lee (2019) discovered that EM has a considerable impact on the attitude towards upcycled products. In the context of EVs, emotional reactions are derived from the EV's condition and brand. For example, a consumer's dissatisfied

feelings with the time and money spent on maintaining the car would develop a negative intention to purchasing EVs of a certain brand.

Finally, EP is the satisfaction of acquiring information from a product to fulfil one's curiosity, desire for knowledge, and novelty-seeking (Sanchez-Fernandez and Iniesta-Bonillo, 2007; Wu and Chang, 2016). EP is found when consumers encounter a new product and are curious about its new appearance, function, and quality; this makes them desire more product knowledge and thus, lean towards purchasing it to satisfy their curiosity (Zailani et al., 2019). Specifically, if a manufacturer comes up with a new product with a value-added feature that has never been unveiled before, consumers' curiosity would be stimulated to try something new (Lin et al., 2010). Previous studies have uncovered positive relationships among consumers' EP, attitude, and purchase intention towards biofuels (Zailani et al., 2019) and green products (Lin et al., 2010; Suki, 2016).

Ultimately, FV, CV, SV, EM, and EP are consumption value dimensions that influence consumers' attitudes (Yu and Lee, 2019). Therefore, this study attempted to inspect the impact of consumption values, as a higher-order construct, on consumers' attitude towards purchasing EVs. The hypothesis was stated as follows:

H4 Consumption values have a positive and significant influence on the attitude towards EVs.

2.8 Government intervention

GI includes both monetary and non-monetary policies. Financial incentives are one of the most popular policies to promote EV adoption. Specifically, tax subsidies, tax exemptions, rebates, toll reduction, free parking, and more are among the most effective ways to boost the adoption of EVs. For example, the United States federal government offers a federal income tax acclaim to new EV purchasers based on their vehicle's battery power and mass rating (Li et al., 2020a).

In addition, non-financial policies, such as special lane access and accessibility in charging stations, have been proven to play an essential part in promoting EV adoption. For instance, vehicle registration privilege is granted to EVs in China's big cities, like Beijing and Shanghai. Furthermore, there are restrictions on petrol-powered vehicles to enter towns or cities to alleviate traffic congestion and pollution (Li et al., 2020b). Hence, it is evident that government support is crucial for the market diffusion of innovative products and services like EVs (Kim et al., 2018).

Overall, GI can foster EV adoption (Ajanovic and Haas, 2016; Langbrock et al., 2016). With the government providing incentives for the purchases of EVs in Malaysia, such as by implementing policies that benefit EV owners and building infrastructure like EV charging stations to be as accessible as petrol stations in Malaysia, the purchase intention of EVs in Malaysia could be indirectly strengthened (Mustapa et al., 2020). In line with this, Broadbent et al.'s (2021) study on EV purchase intention in New Zealand found that public policies shift consumer attitudes. As a result, the following hypothesis was proposed:

H5 GI has a positive and significant influence on the attitude towards EVs.

2.9 Attitude towards EVs

Attitude is defined as an individuals' assessment of a behaviour as desirable or undesirable (Ajzen, 1991). It refers to the extent of a person's favourable or unfavourable appraisal of the behaviour being gauged. Attitude is often used as a synonym for habit (Bean, 1928). A more favourable attitude should be expressed as stronger individual intentions (Dickinger and Kleijnen, 2008). For example, it has been shown that the aim to purchase an energy-efficient product is strongly associated with the attitude towards the product (Ha and Janda, 2012). Prior studies have assessed the positive association between attitude and purchase intent in various contexts, such as online purchasing (Cheah et al., 2015), label food products (Jaafar et al., 2012), halal brands (Sama and Trivedi, 2019), and energy-efficient products (Fatoki, 2020). Hence, consumers would buy EVs if they have a favourable feeling towards utilising them. In other words, consumers' affirmative perception towards EVs will shape their goal to purchase EVs (Renny et al., 2013), as proposed in the hypothesis below:

H6 The attitude towards EVs has a positive and significant influence on the purchase intention towards EVs.

2.10 EA as a mediator

Environmental concern and eco-knowledge are the components of EA. Environmental concern is an individual's attitude towards implications for the natural habitat, while environmental knowledge is his/her ability to distinguish between environment-related signs, concepts, and attitudes (Demir et al., 2021). Taken together, EA is individuals' emotional stance on the environment, which includes their dislike of those who do not care about it (Leong and Paim, 2015). Individuals with EA would therefore put emphasis on the environmental impacts of EVs from their production to their delivery to end customers. This environmentally friendly approach is prone to encourage consumers' positive attitude towards obtaining EVs (Chu, 2018).

Studies have found purchase intention to be impacted by consumers' environmental knowledge or concern in terms of green products (Dehghanan and Bakhshandeh, 2014), eco-friendly cars (Xu et al., 2019a), and shared ride-hailing services (Goel and Haldar, 2020). However, Bashirun and Noranee's (2020) study revealed that environmental knowledge does not significantly influence the attitude towards green behaviour. Due to contrasting past empirical results, this study investigated EA as a potential mediator from the perspective of EV purchase intention.

Song et al. (2019) stated that EA has a mediating role in consumers' decision to purchase green products. Similarly, Abidin et al. (2021) revealed that EA has a mediating effect on revisit intention to a specific tourist destination. When people start evaluating a product according to their ecological knowledge and weigh its benefits or damage to the environment, they will certainly alter their purchase intention towards the product. In this case, the evaluation of the environmental advantages and disadvantages brought by the adoption of EVs will indirectly influence the purchase intention of consumers towards these vehicles. Hence, the following hypothesis was developed:

H7 EA mediates the relationship between attitude towards EVs and purchase intention towards EVs.

3 Research methodology

A quantitative research methodology via a self-administered questionnaire was employed in this study to delve into the factors motivating consumers' intention to purchase EVs (Fatoki, 2020). Six items were adopted from Torres and Gutiérrez (2007) to measure purchase intention, while three items for attitude were derived from Han et al. (2017). Thirty-four items were used to measure consumption values, where seven items measured EM (Teoh and Noor, 2015), eight items measured FV (Lin et al., 2010), nine items measured CV (Wu and Chang, 2016), six items measured SV (Kim et al., 2011), and four items measured EP (Al-Debei and Al-Lozi, 2014). Next, the five items for EA were adopted from Xu et al. (2019b). To measure PEOU and PU, six and eight items respectively were drawn from the works of Davis (1989) and Müller (2019). Finally, GI was measured using six items adopted from Kim et al. (2018). All constructs were rated on a seven-point Likert scale affixed from '1 – strongly disagree' to '7 – strongly agree'.

Convenience and judgmental sampling methods were adopted, through which 200 questionnaires were distributed to working adults in Klang Valley. According to WapCar News (2021), "Malaysia has the fourth worst traffic jam condition in Southeast Asia and second highest CO_2 emission level". Kuala Lumpur and its neighbouring state Selangor, in particular, have the most severe traffic conditions (Heinrich Böll Stiftung Southeast Asia, 2022), which justifies the selection of Klang Valley as the sampling area. After filtering out non-viable questionnaires (e.g., central tendency or >30% unfilled), only 126 questionnaires were usable for further analysis. Although the sample size of 126 is considered small, it was sufficient for this study as it surpassed the threshold size of 55 recommended by a power analysis with a 0.15 effect size at an 80% power level (Fink, 2017). Respondents' information was kept confidential and anonymous. The SPSS version 23 software was used to input the data from the questionnaires, which was later analysed using SmartPLS version 3.0 to perform partial least squares structural equation modelling (PLS-SEM), as suggested by Ringle et al. (2015).

4 Results

4.1 Respondents' demographic profile

The study sample involved 126 respondents, of whom 57.1% were male and 42.9% were female. A majority of them were Chinese (85.7%), aged between 18 and 24 years old (60.3%), and single (84.9%). In terms of education, 83.3% of the respondents possessed at least a bachelor's degree or a diploma. Lastly, most of the respondents (48.4%) reported earning a monthly income between RM2500 and RM3999.

4.2 Measurement model evaluation

Following the two-step procedure of PLS-SEM, the reflective measurement model was evaluated first. Table 1 demonstrates that the outer loadings for most items exceeded the suggested value of 0.708 (Hair et al., 2014). Items CV6, EM5, FV1, FV2, FV3, PU5, PU6, PU7, GI1, PI2, and PI5 were removed from the model because they did not reach acceptable loadings. However, some indicators with a loading value lower than 0.708, such as FV4 (0.644), GI5 (0.697), and GI6 (0.683), were maintained since their average

variance extracted (AVE) values succeeded in reaching the criterion of 0.5 (Ramayah et al., 2018). Likewise, the composite reliability (CR) values for all constructs satisfied the limit of 0.7 (Hair et al., 2010). Moreover, Table 1 conveys that the study's constructs realised the recommended level of 0.5 for AVE, which implies that the items weighed in a similar construct represented more than 50% of the variance of the construct (Hair et al., 2014).

Table 1 Reflective measurement model: factor loadings, CR, and AVE

Construct	*Loadings*	*CR*	*AVE*
Conditional value (CV)		0.917	0.580
CV1	0.786		
CV2	0.754		
CV3	0.805		
CV4	0.728		
CV5	0.767		
CV7	0.702		
CV8	0.777		
CV9	0.767		
Emotional value (EM)		0.969	0.837
EM1	0.914		
EM2	0.922		
EM3	0.893		
EM4	0.927		
EM6	0.902		
EM7	0.932		
Epistemic value (EP)		0.909	0.716
EP1	0.896		
EP2	0.914		
EP3	0.730		
EP4	0.831		
Functional value (FV)		0.937	0.751
FV4	0.644		
FV5	0.884		
FV6	0.938		
FV7	0.919		
FV8	0.915		
Social value (SV)		0.935	0.708
SV1	0.799		
SV2	0.923		
SV3	0.819		
SV4	0.782		
SV5	0.873		
SV6	0.842		

Notes: CV6, EM5, FV1, FV2, FV3, PU5, PU6, PU7, GI1, PI2 and PI5 were deleted due to low loadings; AVE = average variance extracted and CR = composite reliability.

Table 1 Reflective measurement model: factor loadings, CR, and AVE (continued)

Construct	*Loadings*	*CR*	*AVE*
Perceived ease of use (PEOU)		0.948	0.752
PEOU1	0.909		
PEOU2	0.871		
PEOU3	0.906		
PEOU4	0.774		
PEOU5	0.864		
PEOU6	0.871		
Perceived usefulness (PU)		0.877	0.588
PU1	0.737		
PU2	0.732		
PU3	0.826		
PU4	0.785		
PU8	0.752		
Government intervention (GI)		0.889	0.618
GI2	0.905		
GI3	0.791		
GI4	0.831		
GI5	0.697		
GI6	0.683		
Environmental awareness (EA)		0.933	0.736
EA1	0.892		
EA2	0.887		
EA3	0.802		
EA4	0.890		
EA5	0.814		
Attitude towards electric vehicle (ATT)		0.958	0.885
ATT1	0.928		
ATT2	0.945		
ATT3	0.949		
Purchase intention towards EV (PI)		0.922	0.748
PI1	0.895		
PI3	0.807		
PI4	0.914		
PI6	0.839		

Notes: CV6, EM5, FV1, FV2, FV3, PU5, PU6, PU7, GI1, PI2 and PI5 were deleted due to low loadings; AVE = average variance extracted and CR = composite reliability.

Table 2 presents the results of the discriminant validity assessment. The heterotrait-monotrait (HTMT) ratio (Henseler et al., 2015) was exercised to detect

whether high multicollinearity existed, so as to verify discriminant validity. The outcomes indicated that all constructs were substantially distinct at $HTMT_{0.90}$ (Gold et al., 2001) and $HTMT_{0.85}$ (Kline, 2011). As a result, discriminant validity was achieved.

Table 2 Discriminant validity: HTMT criterion

	AT	*CV*	*EM*	*EA*	*EP*	*FV*	*GI*	*PEOU*	*PU*	*PI*	*SV*
AT											
CV	0.751										
EM	0.827	0.827									
EA	0.681	0.530	0.600								
EP	0.804	0.648	0.797	0.621							
FV	0.69	0.635	0.751	0.634	0.616						
GI	0.112	0.229	0.152	0.281	0.198	0.309					
PEOU	0.285	0.43	0.244	0.371	0.462	0.220	0.445				
PU	0.578	0.633	0.432	0.594	0.441	0.432	0.638	0.640			
PI	0.810	0.669	0.636	0.738	0.587	0.511	0.488	0.538	0.846		
SV	0.450	0.752	0.579	0.337	0.510	0.351	0.360	0.583	0.643	0.474	

Notes: HTMT < 0.85 (Kline, 2011); HTMT < 0.90 (Gold et al., 2001).
AT = attitude towards electric vehicles; CV = conditional value;
EM = emotional value; EA = environmental awareness; EP = epistemic value;
FV = functional value; GI = government intervention; PEOU = perceived ease of use; PU = perceived usefulness; PI = purchase intention towards electric vehicles;
SV = social value.

4.3 Formative second-order construct assessment

Table 3 displays the collinearity estimation results of consumption value as a formative second-order construct. The variance inflation factor (VIF) values for all lower-order constructs were less than the maximum value of 5.0 (Diamantopoulous and Siguaw, 2006; Hair et al., 2011), validating that these constructs were definite and appraised diverse aspects of consumption value. Therefore, estimating the PLS path model was feasible.

Table 3 Collinearity assessment for formative second-order construct

	Consumption value
CV	3.379
EM	4.391
EP	2.275
FV	2.123
SV	2.161

Subsequently, the formative constructs' outer weight significance was assessed. Table 4 illustrates the bootstrapping outcomes, where the weights and path coefficients for CV, EM, and EP were significant (Hair et al., 2011), while they were insignificant for FV and SV. However, these indicators were retained in the formative construct as prior research and theory (i.e., Teoh and Mohd Noor, 2015; Kim et al., 2011) provide support for the

relevance of these indicators in capturing the consumption value construct. Nevertheless, further testing was performed on outer loadings to verify maintaining the indicators. The results in Table 5 show that all loadings were above 0.5 while t-value results exceeded 1.645. Thus, FV and SV could be kept in the formative construct (Hair et al., 2017).

Table 4 Path coefficient assessment for outer weights of second-order construct

	Direct effect (β)	*Standard error*	*T-statistic*	*P-value*
CV → CONS	0.360	0.124	2.905**	0.004
EM → CONS	0.362	0.156	2.321*	0.021
EP → CONS	0.432	0.098	4.400**	0.000
FV → CONS	0.105	0.092	1.133	0.258
SV → CONS	–0.174	0.106	1.647	0.100

Notes: **p < 0.01, *p < 0.05 (one-tailed).
CV = conditional value; EM = emotional value; EP = epistemic value;
FV = functional value; SV = social value; CONS = consumption value.

Table 5 Path coefficient assessment for outer loadings of second-order construct

	Direct effect (β)	*Standard error*	*T-statistic*	*P-value*
CV → CONS	0.838	0.052	16.244**	0.000
EM → CONS	0.930	0.030	30.614**	0.000
EP → CONS	0.882	0.046	19.201**	0.000
FV → CONS	0.756	0.058	12.923**	0.000
SV → CONS	0.561	0.094	5.977**	0.000

Notes: **p < 0.01, *p < 0.05 (one-tailed).
CV = conditional value; EM = emotional value; EP = epistemic value;
FV = functional value; SV = social value; CONS = consumption value.

4.4 Structural model assessment

Before the structural model was evaluated, the inner model of the study was tested to ensure it was free of lateral collinearity issues. Table 6 reveals that all the constructs' inner VIF values were lower than the maximum limit of 3.3 (Diamantopoulous and Siguaw, 2006); hence, lateral multicollinearity was not a concern in this study.

Table 6 Collinearity assessment

	ATT	*PU*	*PI*
ATT			1.656
PEOU	1.568	1.000	
CONS	1.513		
GI	1.665		
PU	2.393		

Notes: ATT = attitude towards electric vehicles; GI = government intervention;
PEOU = perceived ease of use; PU = perceived usefulness; PI = purchase intention towards electric vehicles; EA = environmental awareness;
CONS = consumption value.

Figure 1 The structural model

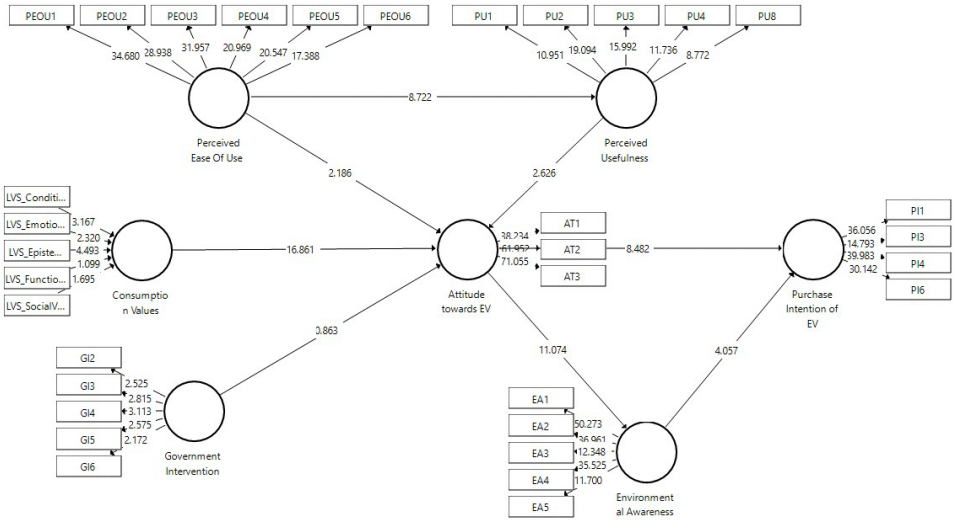

Table 7 Path coefficient assessment for direct hypotheses

Hypothesis	*Direct effect (β)*	*Standard error*	*T-statistic*	*P-value*	*Confidence interval (BC)*		*Decision*
					LL	*UL*	
H1: PEOU → ATT	–0.148	0.067	2.186*	0.015	–0.266	–0.055	Not supported
H2: PEOU → PU	0.580	0.067	8.722**	0.000	0.452	0.674	Supported
H3: PU → ATT	0.215	0.082	2.626**	0.004	0.081	0.339	Supported
H4: CONS → ATT	0.786	0.047	16.861**	0.000	0.690	0.838	Supported
H5: GI → ATT	0.080	0.092	0.863	0.194	–0.146	0.188	Not supported
H6: ATT → PI	0.561	0.066	8.482**	0.000	0.443	0.664	Supported

Notes: **p < 0.01, *p < 0.05 (one-tailed).
ATT = attitude towards electric vehicles; GI = government intervention; PEOU = perceived ease of use; PU = perceived usefulness; PI = purchase intention towards electric vehicles; CONS = consumption values.

Figure 1 illustrates the structural model of this study, where PEOU was postulated to influence PU; PEOU, PU, consumption values, and GI were hypothesised to positively influence attitude; and attitude was predicted to lead to higher purchase intention. Path coefficients and significance for the six direct hypotheses were assessed using the bootstrapping method. Table 7 denotes that PEOU ($\beta = 0.580$, $p < 0.01$) has a significant positive relationship with PU. Both PU ($\beta = 0.215$, $p < 0.01$) and consumption values ($\beta = 0.786$, $p < 0.01$) were revealed to be significantly associated with the attitude towards EVs, which in turn, exhibited a significant influence on purchase intention towards EVs ($\beta = 0.561$, $p < 0.01$). Hence, H2, H3, H4, and H6 were supported. On the other hand, PEOU ($\beta = –0.148$, $p < 0.05$) was discovered to be negatively associated with the attitude towards EVs, thus rejecting H1. Likewise, GI ($\beta = 0.080$, $p > 0.05$) showed an insignificant connection with the attitude towards EVs; therefore, H5 was not supported.

Table 8 Hypothesis testing for mediation

Hypothesis	*Direct effect*	*T-statistic*	*Confidence interval (BC)*		*Significance*	*Specific indirect effect*	*T-statistic*	*Confidence interval (BC)*		*Significance*	*Mediation type*
			LL	*UL*				*LL*	*UL*		
H7: ATT → EA → PI	0.561	8.474	0.426	0.685	Yes	0.205	3.597	0.093	0.317	Yes	Complementary (partial mediation)

Notes: ATT = attitude towards electric vehicles; EA = environmental awareness; PI = purchase intention towards electric vehicle.

Next, Table 8 shows the hypothesis testing outcome for the mediation effect of EA. The bootstrapping analysis disclosed that the indirect effect, $\beta = 0.205$, was significant with a t-value of 3.597. Moreover, the indirect effect's 95% confidence interval [LL = 0.093, UL = 0.317] did not straddle a zero, implying that there was mediation (Preacher and Hayes, 2004, 2008). Specifically, complementary or partial mediation was observed in this relationship (Nitzl et al., 2016), which suggests that only a portion of the effect of attitude on purchase intent towards EVs is mediated by EA, while attitude still explicates the remaining percentage of its impact on purchase intention, impartial of EA. Ultimately, it can be deduced that the association between the attitude towards EVs and purchase intent towards EVs is mediated by EA. Hence, H7 was supported.

Table 9 exhibits that the R^2 value of PU was 0.337, which signifies that PEOU accounted for 34% of the variance in PU. Notably, the R^2 value of attitude towards EVs was 0.754, validating that PEOU, PU, consumption values, and GI explained a substantial 75% of the variance in attitude. In addition, the R^2 value of purchase intention towards EVs was 0.651, which suggests that attitude towards EV and EA were responsible for 65% of the variance in purchase intention.

Table 9 Coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2)

	Determination coefficient	*Predictive relevance*	*Effect size (f^2)*			*Effect size*
	R^2	*Q^2*	*AT*	*PU*	*PI*	
AT	0.754	0.616			0.545	Large
PI	0.651	0.438				
PU	0.337	0.176	0.079			Small
CONS			1.664			Large
GI			0.016			Small
PEOU			0.056	0.508		Small/Large

Notes: ATT = attitude towards electric vehicle; GI = government intervention; PEOU = perceived ease of use; PU = perceived usefulness; PI = purchase intention towards electric vehicle; CONS = consumption value.

Table 9 also reveals that the Q^2 values for PU (0.176), attitude towards EVs (0.616), and purchase intention towards EVs (0.438) all exceeded the value zero, thereby establishing that the model had satisfactory predictive accuracy. Finally, Table 9 presents the effect sizes of the exogenous variables on the endogenous variables. Following Cohen's (1988) standards, consumption values ($f^2 = 1.664$) had a large effect size, while PU ($f^2 = 0.079$), GI ($f^2 = 0.016$), and PEOU ($f^2 = 0.056$) had small effect sizes on attitude towards EVs. PEOU ($f^2 = 0.508$) had a large effect size on PU, as did attitude towards EVs ($f^2 = 0.545$) on purchase intention towards EVs. These conclusions highlight that the values of consumption are more vital in rationalising consumers' attitude towards EVs compared to PU, GI, and PEOU. Correspondingly, PEOU is noticeably important in explaining PU, whereas attitude is essential in predicting purchase intention in the EV setting.

5 Discussion

The aim of this study was to explore the factors that influence consumers' intention to purchase EVs. This paper adopted the TCV and TAM models, instead of the TPB, to propose a framework with five determinants and a mediator. The results supported five out of the seven hypotheses. First, the results show that PEOU has a substantial positive connection with PU. This denotes that when consumers perceive that using an EV is easy, they directly form a better perception of the EV's usefulness. With the learning phase of the EV being shortened from the consumers' standpoint, EV is both easier to use and more useful. This finding is in line with that of Yoon (2015) and Raksadigiri and Wahyuni (2020), who also established that PEOU has a noteworthy influence on PU.

Second, the findings indicate a positive and meaningful relationship between PU and the attitude towards EVs. When EVs are deemed to have safety, utility, low maintenance costs, and tax reliefs, consumers would have a positive attitude concerning those vehicles. Hence, the greater the PU, the greater the attitude towards EVs, and consequently, the stronger the purchase target of EVs. Such results are aligned with the study of Tu and Yang (2019) and Yoon (2015), where a positive association was discovered between PU and purchase intention.

Third, consumption values appear to have a favourable and significant influence on the attitude towards EVs, consistent with prior studies by Cuomo et al. (2019), Suki (2016), and Zailani et al. (2019) which discovered that consumption values possess a strong influence on consumers' purchase intention. Moreover, studies have demonstrated that consumption values impact consumers' attitude towards gluten-free products (Jung et al., 2017) and second-hand fashion goods (Choo and Park, 2013).

Fourth, a positive connection was found between the attitude towards EVs and consumers' aim to purchase EVs. This is coherent with previous research that established attitude's reinforcement of the purchase intent towards organic food (Yang et al., 2014) and online food purchasing (Nguyen et al., 2019). Lastly, our results discovered that the link between attitude towards EVs and purchase intent towards EV is mediated by EA. This finding aligns with previous studies that have also found EA to mediate the effects of sustainability and environmental concerns on revisit intention to coastal eco-tourism (Abidin et al., 2021), as well as the conception of science teaching and learning (Salvador et al., 2017). Therefore, the results indicate that consumers are more prone to purchase an EV when they have a positive attitude towards EVs, partially due to their awareness about the environment. Understandably, when consumers are conscious about the environment, they may have a greater intention to purchase EV.

However, two hypotheses were rejected in this study. First, contrary to expectations, PEOU has a significant yet negative correlation with the attitude towards EVs. This points out that when consumers perceive the EV to be easy to function, their attitude towards it is less favourable, likely because they believe that an EV should more technologically advanced and hence, more challenging to understand. If it is easy to understand, consumers may consider the EV to be less technologically advanced and rather questionable; thus, they would have a less favourable attitude towards it. This result contradicts the works of Tu and Yang (2019) and Müller (2019), which stated that consumers' PEOU of EVs has an affirmative and substantial influence on their attitude. Ultimately, the technology-related uneasiness that leaves Malaysian consumers feeling troubled or restless about the use of EVs can explain the negative but significant

relationship found between PEOU and the attitude towards EVs (Rose and Fogarty, 2006).

The second rejected hypothesis was due to the insignificant relationship between GI and the attitude towards EVs, which opposes the study of Tu and Yang (2019). Even with governmental financial incentives (e.g., tax reliefs) and non-financial policies (e.g., charging stations), consumers may not form desirable attitudes towards EVs. This is because Malaysia has not implemented a committed EV policy or plan despite supporting all emission-reducing technologies (Schröder et al., 2021). Furthermore, the price of an EV is far more expensive compared to petrol-powered alternatives. It is also worth mentioning that Malaysia's national carmakers, Proton and Perodua, are not putting research and development efforts into EV development and commercialisation (Lee, 2019).

Another reason is that the infrastruture for EVs is simply not as accessible in Malaysia as it is for petrol-powered cars, given that petrol stations are everywhere but EV charging stations are relatively limited across the country. Therefore, EVs are not easily operable and affordable in Malaysia. Moreover, consumers are not educated in terms of EVs. Therefore, even if EV infrastructure is provided, consumers may still not be keen to learn about it, making the adoption of EV difficult. At this point, only information about carbon emission reduction or going green has been widely spread among consumers. Hence, GI does not influence the attitude of consumers towards EVs.

5.1 Theoretical implications

This study adds to the literature by concurrently assessing the TAM and TCV in exploring the purchase intention of EVs in Malaysia. While limited research has considered EVs in Malaysia, numerous studies have tested purchase intention based on the TAM (Ambak et al., 2016; Müller, 2019) or TCV (Teoh and Mohd Noor, 2015; Ang et al., 2017). Adding to this, the present study enhances extant knowledge by integrating both the TAM and TCV to explain consumers' attitude and purchase intention towards EVs. In particular, apart from investigating PEOU and PU as antecedents of attitude and intention to purchase EVs, our framework also included the dimensions of consumption values (i.e., FV, CV, SV, EM, and EP) to obtain a more well-rounded understanding of consumer behaviour towards EVs in Malaysia.

Furthermore, additional variables such as GI and EA were incorporated to better comprehend the purchase intent of EVs among the Malaysian population. Earlier studies (e.g., Ajanovic and Haas, 2016; Langbrock et al., 2016) have established that GI fosters the purchase intention of EVs. Meanwhile, Ju et al. (2021) found that buyers with a higher level of EA are more inclined to purchase eco-friendly cars in Korea. Likewise, EA has been known to have an immediate impact on the purchase intention of EVs in Japan (Okada et al., 2019). Both these studies, however, were conducted in oriental countries (i.e., Japan and Korea), meaning that their results may not be generalisable to Malaysia. There is also limited research linking GI and EA to EV purchase intention, despite the fact that GI is essential in this context to provide effective financial and non-financial policies to motivate consumers. Similarly, EA is vital in the context of EVs because people with an elevated level of EA are more motivated to purchase EVs. To address these gaps, this paper included these variables to examine their effects on the attitude and purchase intention of EVs in Malaysia.

Finally, this study adds value to the literature by exploring EA as a bridge between the attitude towards EVs and the intention to purchase them. Based on previous studies (i.e., Abidin et al., 2021; Song et al., 2019), EA has a mediating function in influencing consumers' decisions and plans to purchase green products. Nevertheless, from the perspective of EVs, there are limited studies that regard EA as a mediator. Therefore, this study has proven that EA has a mediating effect on the nexus between the attitude and purchase intention towards EVs.

5.2 Managerial implications

From the practical perspective, obtaining a clear understanding on the predictors and effects of consumers' attitude with regard to EVs and their plan to purchase EVs may provide meaningful insights to EV manufacturers and marketers. This knowledge also helps the government develop better strategies and policies for the country's low-carbon vision.

According to the results, EV manufacturers should place emphasis on manufacturing vehicles that are easy to operate and have great functionality. For example, one of the largest and well-known EV manufacturers and brands in the world, Tesla, has all its functions accessible through a large screen via the car's infotainment system, making the car relatively easy to use. Furthermore, the car also has great features like over-the-air system updates and low maintenance costs, as it does not have to be taken to the workshop every year or every 10,000 kilometers for an oil change (Herrmann et al., 2021). This means EV owners have one less worry in their mind, which will increase the possibility of car owners adopting EVs.

Furthermore, EV manufacturers should prioritise building EVs that provide driving pleasure, satisfaction, and happiness by offering great post-purchase services at a reasonable price. Manufacturers can even invent more interesting and creative ideas for the cars' design, technologies, and production, so as to input more complex functions and technologies into the EV to spark consumers' interest. In addition, car makers must build and design EVs to be safer and easily maintained/operated at minimal expenses.

As shown in the results, environmental knowledge and concern should be taught in EA campaigns organised through collaborations between the government and EV marketers. This would allow people to better understand the environment and trigger their awareness to protect the environment, which would increase their purchase intention towards green products like EVs. Ultimately, EV manufacturers and marketers can make use of this study's findings to assimilate additional values that consumers appreciate to stimulate their purchase intention towards EVs.

5.3 Limitations and future research suggestions

In this study, there are a few limitations to be highlighted for future research. First, most the respondents fell in the income bracket of RM2500 to RM3999 (48.4%) and were aged from 18 to 24 years old (60.3%). Future research should consider tapping into a more balanced sample from different income and age ranges to obtain a more generalised result. This is because consumers from different income levels and age groups may have varying living standards and thus, diverse perspectives towards the purchase of EVs. Second, this study adopted a cross-sectional methodology. It is advised that potential research take on a longitudinal method, as with the passing of time, consumers'

understanding, insight, and knowledge of EVs may increase or change, which would affect their purchase intention towards EVs (Ang et al., 2018). Third, the results indicate that the R^2 value of attitude towards EVs was only 0.754 while the R^2 value of purchase intention towards EVs was 0.651. This indicates that about 25% and 35% of the variance in attitude and purchase intention, respectively, were not explained. Thus, future research may consider including additional factors such as price value (Degirmenci and Breitner, 2017), subjective norms (Tu and Yang, 2019) and innovativeness (Lashari et al., 2021) when examining the attitude and purchase intention with respect to EVs. Lastly, the study did not take into account other external factors, such as the opportunity costs of government intervention or tariff barriers in the automotive industry (Lau, 2020), which would directly affect the purchase intention of EVs. Due to trade barriers, EV makers are turning away from investing in Malaysia, thereby limiting the options of EVs in the country (Ahmad, 2018). Therefore, future research may consider examining this aspect, as such barriers can further restrain the growth of the EV subsector in the automobile market.

6 Conclusions

In conclusion, this study aspired to investigate the factors influencing consumers' attitudes and intention to purchase EVs. It is important for developing countries like Malaysia to reduce their oil dependency and improve the environment (Rajper and Albrecht, 2020), especially because Malaysia aims to decrease its CO_2 level by 45% before the year 2030. Our findings show that consumption values and PU have a positive influence on attitude in relation to EVs, which in turn, has a direct link with the purchase intention of EVs. Furthermore, PEOU was found to have a major effect on PU while EA was shown to mediate the relationship between the attitude towards EVs and purchase intention of EVs. Nevertheless, the study has some limitations which future research can address. Specifically, scholars are encouraged to consider a more balanced demographic sample, as well as to take into account factors such as price value, innovation, and government policies, to fully understand consumers' intention towards purchasing EVs. Despite these limitations, the study has contributed to the applicability of the TAM and TCV in the context of EVs. The results offer practical suggestions to marketers and manufacturers of EVs in Malaysia as well as the Malaysian government in forming effective and progressive policies to build a greener community.

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