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Determinants of Electric Car Patronage Intention

Kalisri Logeswaran Aravindan[1], Muhammad Aiman Izzat[1*], Thurasamy Ramayah[2,3,4], Thing Soong Chen[1], Yap Voon Choong[1], Sanmugam Annamalah[5], Narinasamy Ilhavenil[6], Arman Bin Ahmad[7]

[1]*Faculty of Management, Multimedia University, Cyberjaya, Selangor, 63100, Malaysia*
[2]*School of Management, Universiti Sains Malaysia (USM), Minden, Penang, 11800, Malaysia*
[3]*Department of Information Technology & Management, Daffodil International University, Birulia, 1216, Bangladesh*
[4]*The University of Jordan, Aljubeiha, Amman, 11942, Jordan*
[5]*School of Business, SEGI University College, Kuala Lumpur, 50010, Malaysia*
[6]*Institute of Teacher Education Special Education Campus, Bandar Tun Razak, Kuala Lumpur, 56000, Malaysia*
[7]*Department of Marketing Universiti Kuala Lumpur Business SchoolUniversiti Kuala Lumpur, Malaysia*

Abstract. Electric vehicles have been popularized as an environmentally friendly alternative to fuel-based transportation. The Malaysian government and vehicle manufacturers have encouraged the adoption of electric cars, yet Malaysians are seen to be lagging in adopting electric cars. This study is poised to examine the determinants of consumers' purchase intention on electricity, underpinned by The Extended Theory of Planned Behaviour. This quantitative research is set on purposive sampling while PLS-SEM is utilized for data analysis. Findings from 362 respondents reveal that technology readiness, perceived cost, perceived symbol, and knowledge lead to electric car purchase intention. This study provides insights for policymakers and manufacturers towards encouraging purchase intention of electric cars.

Keywords: Electric car; Environmentally-friendly; PLS-SEM; Purchase intention

1. Introduction

Climate change and carbon emissions are amongst the most pressing challenges facing mankind on a global scale. According to NASA (2019), the present symptoms, such as a drastic rise in temperature, reflect an alarming scenario. In the past, 196 countries, including Malaysia, have pledged in the Paris Agreement to reduce 45% of carbon emissions by 2030 (United Nations, 2016). In line with this, the Malaysian government has ingrained this goal, being part of the National Energy Policy 2022-2040 and the 12th Malaysia Plan.

Promoting environment-friendly transportation systems is essential to prevent catastrophes (Suwartha *et al.*, 2021), especially in Malaysia, where transportation accounts for 30% of energy consumption (Ministry of Transportation Malaysia, 2017). Thus, electric cars are promoted as an efficient option for their ability to operate partially or fully on electric motors and hence consume little to zero fossil fuels in addition to total ownership cost advantages as compared to conventional vehicles (Suwignjo *et al.*, 2023). In the past

*Corresponding author's email: zailan.izzat@gmail.com, Tel.: +6017-2728753
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years, the Malaysian government has encouraged the usage of electric cars by introducing several policies, including the subsidization of electric car sales.

Despite the Malaysian government's encouragement of electric cars through various incentives, the adoption rate remains very low. In 2022, only 10,000 units were recorded, falling significantly short of the target of achieving 100,000 electric cars by the year 2020 (Paul Tan, 2022; Paul Tan, 2016). Therefore, this study is done to uncover the factors that encourage the purchase intention of electric cars, which will eventually facilitate their adoption. Although a string of research was done on the adoption of electric cars, there was a scarcity of examining purchase intention from positive and negative perceptions (He, Zhan, and Hu, 2018) thus this study offers a unique perspective by examining the five determinants of the electric car purchase intention namely technology readiness, perceived cost, perceived symbol, electronic word of mouth, and knowledge based on the Extended Theory of Planned Behaviour (ETPB) model.

2. Theoretical Development and Literature Review

The Theory of Planned Behaviour (TPB) has been widely employed in purchase intention research. This theory posits that human behavior is governed by behavioral intentions, which are influenced by the person's attitude towards a particular behavior (expectation of its outcomes), subjective norms (social pressure), as well as perceived behavioral control (the extent to which the behavior is easy or difficult to perform). No doubt, TPB has been widely used in various settings, but ETPB is seen to be more apt and fitting for electric car/vehicle research (Shalender and Sharma, 2020) as such, ETPB would yield a better explanation while providing valuable insights into the determinants of electric car purchase intention. The research framework for this study is as follows.

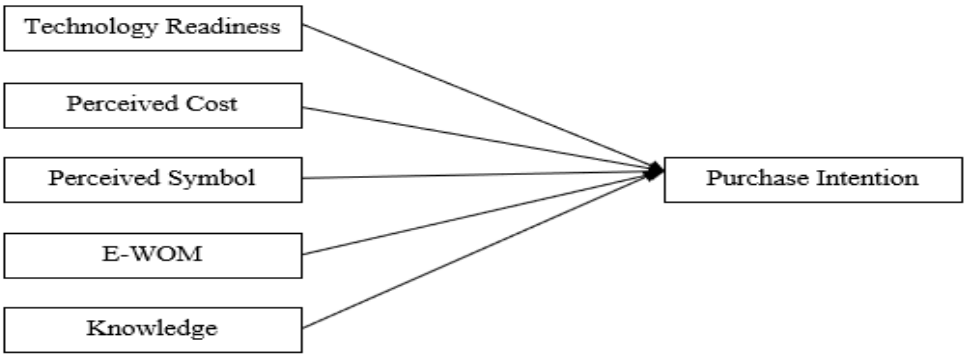

Figure 1 Research framework

2.1. Technology Readiness

Technology readiness is the extent to a consumer is open to a technology's development (Tahar *et al.*, 2020) and in electric cars context, it relates to charging time and range, as well as the adequacy of infrastructure namely charging stations. In fact, researchers have especially highlighted charging time and range as a major obstacle in using electric cars (Whulanza, 2023) but subsequent improvements backdropped by Tesla's investment in Malaysia is expected to delineate the shortcomings. For instance, newer electric car models such as Tesla Model S Dual Motor could travel up to 575 km on a single charge (Electric Vehicle Database, 2023), underlined by initiatives to increase charging stations in Malaysia (Paul Tan, 2023). Yet, a study by Habich-Sobiegalla, Kostka, and Anzinger (2018) reveals technology readiness is insignificant towards electric car purchase intention in Brazil, China and Russia. Nevertheless, considering the Malaysian context, the first hypothesis is formulated as follows.

H1: Technology readiness is positively related to electric car purchase intention.

2.2. Perceived Cost

Perceived cost refers to the consumers' perception of the monetary expenses involved in owning and driving an electric car. It encompasses the price of the electric car and subsequent costs of ownership. Perceived cost impacts purchase (Habich-Sobiegalla, Kostka, and Anzinger, 2018). Similarly, Shen and Wang (2022) argued that moral obligations toward the environment transpire if the monetary costs involved are lower. Therefore, the second hypothesis is formulated as follows:

H2: Perceived cost is negatively related to electric car purchase intention.

2.3. Perceived Symbol

Perceived symbol refers to the consumers' perception of the status or public image that purchasing an electric car would garner, as electric cars may not only be a transportation mode but a status symbol and a reflection of their pro-environmentalist and innovative identity. Studies have reported a positive relationship between perceived symbols and electric car purchase intention, such as Okada *et al.* (2019) in Japan. Therefore, the third hypothesis is formulated as follows:

H3: Perceived symbol is positively related to electric car purchase intention.

2.4. Electronic Word of Mouth

Technological advancements have harnessed social media usage, making it a part of daily life for various purposes, including testimonials and recommendations (Abed, 2018), thus generating electronic word-of-mouth (eWOM). Compared to traditional word-of-mouth, which spreads through face-to-face interactions, electronic word-of-mouth (eWOM), transmitted through electronic mediums, is considered the most prevalent means for individuals to share their opinions and reviews (Maulida *et al.*, 2022). Given the low electric car adoption in Malaysia, eWOM assures information could be acquired not only from within Malaysia but also from other proponents around the world (Qiu *et al.*, 2023). Jing (2023) found that eWOM has a positive, significant, and strongest influence on electric car purchase intention in Finland, although Riansyah *et al.* (2023) reported a contradicting outcome for Indonesia. This research, however, would formulate a fourth hypothesis as below, given the forthcoming Tesla's entry to Malaysia.

H4: Electronic word of mouth is positively related to electric car purchase intention.

2.5. Knowledge

Knowledge is the core of consumers' decision-making (Huang and Ge, 2019), where it facilitates positive attitudes toward ecological products (Amoako, Dzogbenuku, and Abubakari, 2020) while helping to mitigate the perceived risks (Wang, Ma, and Bai, 2019). Thus, consumers tend to be more receptive to electric cars when knowledge such as performance, charging time, range, and benefit are present (Wang *et al.*, 2018). Previous studies have reported a positive and significant relationship between knowledge of electric cars and purchase intention (Kim *et al.*, 2019). Therefore, the following hypothesis is developed.

H5: Knowledge is positively related to electric car purchase intention.

3. Methodology

This quantitative research uses a survey questionnaire adopted or adapted from past validated studies. A purposive sampling method was employed while the unit of analysis is individuals who own a valid driving license and fuel-based car. A self-administered Google

survey form was given to 500 recipients in Klang Valley and eventually received 362, hence a response rate of 72.4%. The data was analyzed using PLS-SEM.

4. Results and Discussion

4.1. Data Analysis

4.1.1. Data Screening.

The screening was conducted to ascertain missing values and suspicious patterns guided by Sekaran and Bougie (2020) and Hair *et al.* (2017), respectively. In testing for common method bias, Podsakoff, Mackenzie, and Lee, 2003, procedural treatment was undertaken, followed by the full-collinearity VIF method proposed by Kock (2012) using SmartPLS. All VIF values were found to be below 3.3 (Kock, 2015). Thus, this indicates no serious threat of common method bias.

4.1.2. Measurement Model

Reliability and convergent validity were tested based on the composite reliability (CR), factor loading, and average variance extracted (AVE). Factor loading values between 0.40 and 0.70 can still be maintained if the composite reliabilities are above 0.70 and the AVE values are above 0.50 (Hair *et al.*, 2017). As shown in Table 1, all the Composite Reliability was greater than 0.7, and the Average Variance Extracted was also greater than 0.5. Whereas discriminant validity was done using HTMT (Henseler, Ringle, and Sarstedt, 2015) with a cut-off value of 0.85. As seen in Table 2, all the HTMT values of each construct is found to be below 0.85. Thus, we can conclude that the measurements are valid and reliable, and all constructs in this study are distinct.

Table 1 Measurement Model

Variable	Item	Loadings	CR	AVE
Electronic Word of Mouth	EWOM1	0.865	0.949	0.822
	EWOM2	0.971		
	EWOM3	0.916		
	EWOM4	0.872		
Knowledge	KNOW1	0.787	0.846	0.584
	KNOW2	0.833		
	KNOW3	0.550		
	KNOW4	0.851		
Perceived Cost	PC1	0.862	0.879	0.646
	PC2	0.808		
	PC3	0.835		
	PC4	0.701		
Purchase Intention	PI1	0.848	0.945	0.810
	PI2	0.946		
	PI3	0.912		
	PI4	0.892		
Perceived Symbol	PS1	0.802	0.891	0.673
	PS2	0.860		
	PS3	0.825		
	PS4	0.792		
Technology Readiness	TR1	0.830	0.794	0.501
	TR2	0.770		
	TR3	0.720		
	TR4	0.452		

Note: KNOW5 was deleted due to low loading

4.1.3. Structural Model

To test the hypotheses generated, we ran a bootstrapping with a 5,000 resample (Ramayah *et al.*, 2018; Hair *et al.*, 2017) to generate the standard deviation, t-values, and p-values. First, we assessed how good is our in-sample prediction by evaluating the R2. The R2 was 0.561 (Q2 = 0.451), indicating that all 5 variables taken together can explain 56.1% of the variance in purchase intention, and the blindfolding procedure with an omission distance of 9 returned a value of 0.451, which was well above the recommended value of 0 thus confirming the predictive relevance of the model.

Technology Readiness (β = 0.335, p< 0.01), Perceived Symbol (β = 0.303, p< 0.01) and Knowledge (β = 0.289, p< 0.01), and E-WOM (β = 0.074, p< 0.05) were all positively related to purchase intention while Perceived Cost (β = -0.245, p< 0.01) was negatively related to purchase intention. Thus, H1, H2, H3, H4 and H5 were supported.

To test for out-of-sample prediction, we followed the suggestions of Shmueli *et al.* (2019) and ran the PLS-Predict procedure with a 10-fold and 10-repetition setting. As shown in Table 4, the results returned a Q2_predict of 0.542 for the latent construct and for the measurement variables; all items showed that the errors in the Partial Least Squares (PLS) model were lower than the errors in the Linear Model (LM) thus indicating that our model has a high predictive power.

Table 2 Discriminant Validity (HTMT Ratio)

Variable	1	2	3	4	5	6
1. Electronic Word of Mouth						
2. Knowledge	0.278					
3. Perceived Cost	0.147	0.263				
4. Purchase Intention	0.274	0.428	0.359			
5. Perceived Symbol	0.407	0.423	0.263	0.650		
6. Technology Readiness	0.236	0.207	0.362	0.527	0.398	

Table 3 Hypotheses Testing

Hypothesis	Relationship	Std. Beta	Std. Dev.	t-value	p-value	BCI LL	BCI UL	f^2
H1	TR → PI	0.335	0.043	7.832	*p< .001*	0.263	0.401	0.207
H2	PC → PI	-0.245	0.034	7.105	*p< .001*	-0.298	-0.186	0.122
H3	PS → PI	0.303	0.037	8.118	*p< .001*	0.242	0.363	0.134
H4	EWOM → PI	0.074	0.039	1.876	0.030	0.006	0.135	0.030
H5	KNOW → PI	0.289	0.043	6.686	*p< .001*	0.219	0.360	0.154

Table 4 PLS-Predict

	PLS		LM		PLS-LM		
MV	RMSE	MAE	RMSE	MAE	RMSE	MAE	Q^2_predict
PI4	0.781	0.636	0.834	0.705	-0.053	-0.069	0.424
PI3	0.690	0.572	0.836	0.691	-0.146	-0.119	0.474
PI2	0.628	0.512	0.760	0.642	-0.132	-0.130	0.471
PI1	0.680	0.507	0.869	0.702	-0.189	-0.195	0.381

4.2. Discussion

Based on the findings, technology readiness is observed to have a positive and significant relationship with the purchase intention of electric cars. Drawing on previous studies, Habich-Sobiegalla, Kostka, and Anzinger (2018) contrarily found that technological readiness insignificantly influenced electric car purchase intention for consumers in Brazil, China, and Russia. However, in the Malaysian context, there may be a greater likelihood of increasing the consumers' purchase intention if policymakers and electric car manufacturers were to emphasize the technological facets, such as having more abundant

and accessible charging stations, increasing driving range per charge, and building more electric car service centers.

Secondly, perceived cost is found to be negatively related to purchase intention. This finding is consistent with previous studies (Habich-Sobiegalla, Kostka, and Anzinger, 2018). Hence, the Malaysian government could consider introducing more lucrative incentives such as subsidies and tax reliefs for purchasing electric cars. This may lower the consumers' resistance to the high upfront costs of owning an electric car. Not only that, manufacturers could also work on introducing affordable electric car models to further attract the interest of mainstream consumers.

Thirdly, the perceived symbol is found to have a positive and significant relationship with purchase intention. This finding is consistent with that of previous studies, such as by Okada *et al.* (2019). Therefore, promotional efforts for the sale and usage of electric cars could emphasize electric cars as a status symbol. With that, such efforts could reflect the pro-environmentalist and innovative image that is commonly associated with electric car owners.

Fourthly, electronic word-of-mouth is found to have an insignificant relationship with purchase intention. This finding is similar to that of a study conducted by Riansyah *et al.* (2023), albeit focusing on a particular electric car model, Wuling Air Electric Car. Thus, it may be more effective to focus on building offline word-of-mouth by emphasizing offline promotional strategies. This may include hosting face-to-face events, whereby consumers can have a firsthand experience with electric cars, as well as interact with the sales representatives on a more personal level.

Fifthly, knowledge is found to have a positive and significant relationship with purchase intention. This finding reflects that of previous studies (Kim *et al.*, 2019). It is worth noting that while most respondents are aware of the environmental benefits of electric cars, they are not as knowledgeable about their economic and technological benefits. Thus, organizing campaigns and road shows can be beneficial in improving the consumers' purchase intention. Better yet, such initiatives can focus on educating consumers on not only the environmental aspect of electric cars but also the economic and technological aspects.

5. Conclusions

In a nutshell, this study is meant to examine the determinants that influence the consumers' purchase intention of electric cars. As the findings have shown, technology readiness, perceived cost, perceived symbol, and knowledge have a significant relationship with electric car purchase intention, while electronic word-of-mouth has an insignificant influence on electric car purchase intention. However, this study is not without its limitations. For instance, the data is solely collected from the Klang Valley area. Bearing the fact that the average household income and education level in Klang Valley are different as compared to other areas in Malaysia, the results could vary. Additionally, this study did not consider the influence of owning a second vehicle on purchase intention, as many households in Malaysia own more than one vehicle. It is possible that a consumer who is looking to purchase a secondary vehicle may not be as concerned with similar factors as one who is purchasing a primary vehicle. Thus, future research may consider addressing these limitations to garner richer insights into electric car purchase intention.

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