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DRIVING THE GREEN VEHICLES SHIFT: AN EVALUATION OF MALAYSIAN CONSUMERS' ACCEPTANCE

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ABSTRACT

With the current drastic changes in global weather, more countries are worried about the sustainability of the ecosystem. Global leaders are more concerned about the drastic climate change, and various initiatives are being taken to prevent further damage to the ecosystem. In Malaysia, the transportation sector, mainly motor vehicles, emitted approximately 97% of carbon monoxide to the environment, causing harmful air pollution. Because of this, green vehicles were introduced to overcome this problem. However, there remain various challenges that may impede or trigger the interest of Malaysian consumers in accepting green vehicles. Thus, this study applies the cognitive-affection model to predict the consumers' intention to accept green vehicles. Using a purposive sampling among current vehicle drivers, a face-to-face survey was conducted and gathered a total of 606 responses. Data were analysed using statistical measurements such as descriptive analysis, exploratory factor analysis and structural equation modelling. Five latent factors such as consumers' acceptance, perceived quality, perceived value (environmental concern, acquisition and maintenance cost), and government policies were identified. The results indicated that perceived value (environmental concern), perceived quality, and government policies have a strong positive relationship with consumers' acceptance. The perceived value showed a negative relationship with consumer acceptance, indicating that consumers would only consider accepting green vehicles if they were cheaper and had a low maintenance cost.

Keywords: Acceptance, cognitive affection model, green vehicle, government policies

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1. INTRODUCTION

The rapid growth of the global economy and technology has damaged the ecological environment and raised global concerns about the sustainability of mother nature (Tu, 2002). Passenger vehicles emit 14 million tonnes of carbon dioxide per day and consume 36 million barrels of oil per day. (Sang & Bekhet, 2015). Therefore, replacing traditional vehicles with new green vehicles will be one of the solutions to tackle environmental issues (IEA, 2017). Transportation vehicles are categorised into fuel-efficient automobiles, alternative fuel cars, flexible fuel cars, elective cars, and hybrid-electric cars (US Environmental Protection Agency, 2018). Table 1 shows the classifications of vehicle types.

Table 1: Classification of the Vehicle Types

No.	Vehicle Type	Description	Examples
1	Fuel-efficient vehicles	Use less gasoline than other cars to travel the same distance.	Multi-brands
2	Alternative fuel vehicles	Run-on fuels other than gasoline.	Toyota Prius
3	Flexible fuel vehicles	Run-on gasoline but can also use a blend of up to 85% ethanol.	Chevrolet Impala, Ford Escapade
4	Electric vehicles	Powered by an electric motor instead of a gasoline engine.	Nissan Leaf, Tesla
5	Hybrid-electric vehicles	Combine the benefits of gasoline engines and electric motors.	Lexus ct200h, Toyota Prius, Volvo XC60

Source: US Environmental Protection Agency, EPA (2018).

The development of electric and hybrid-electric vehicles, traffic status, and road usage will improve the environment and balance energy consumption (Eltayeb et al., 2010). According to Singh (2018), the global sales of electric vehicles are poised to increase from 1.2 million in 2017 to 1.6 million in 2018. Even though the sales reached 2.2 million units in 2019, the major challenges of the electric vehicle sector continue to be related to the charging speed, equipment and services (Circontrol Mobility and eMobility, 2020). Currently, only Japan has reached a stage where the electric car charging stations (40,000 stations nationwide) have exceeded the conventional petrol stations (34,000 stations) (McCarthy, 2016). According to Diamond (2009), lack of understanding, high cost, and unreliability are barriers to consumers adopting new technology, including green technologies. Oliver and Rosen (2010) noted that only a minority of consumers initially accept green vehicles due to the trade-off between higher acquisition and maintenance costs and fuel efficiency savings.

In hindsight, Hyundai Motor Co. and Kia Motor Corp. recorded the second-largest volume (102,480 units) of shares through sales of green vehicles during the first half of 2017 due to the debut of their electric and hybrid-electric vehicles (HEVs) in the B-segment of motorcars (Park, 2017). HEV sales grew 151.7% (from 3,948 to 9,936 units) and green vehicle sales grew 123.7% (from 40,518 to 90,659 units), surpassing Honda, Ford, and BMW (Table 2).

Table 2: Global Automakers' Green Vehicle Annual Sales (in Units)

Automakers	2015	2016	First Half of 2017
Toyota	1,082,291	1,233,446	598,136
Hyundai and Kia	73,592	107,822	102,480
Honda	231,087	235,547	80,780
Ford	68,297	77,188	51,150
Renault-Nissan	81,373	88,325	50,360
Tesla	45,996	69,568	37,842
BMW	32,972	59,792	35,785
Volkswagen	63,056	62,782	31,662
GM	24,063	34,565	23,857
Daimler	27,246	28,387	18,433

Source: Park (2017).

Due to resource scarcity and environmental concerns, green vehicles will become the mainstream development trend in the automotive industry (Tu & Yang, 2019). To reduce environmental impact and understand consumer acceptance, energy-saving, low-carbon dioxide emission green vehicles must be developed. With information exchange and values, consumers will have more purchase options. (Chiang, 2014). Despite green vehicle popularity, the electric vehicle market ratio is still low (Tu & Yang, 2019). Table 3 shows the comparison between the global total green vehicle and vehicle sales from 2014 to 2018. Table 4 shows the comparison between the total ASEAN green vehicle and vehicle sales from 2014 to 2018.

Table 3: Comparison between Global Total Green Vehicle and Vehicle Sales

Year	2014	2015	2016	2017	2018
Green Vehicle Sales (Units)	1,887,496	1,913,078	2,447,807	3,164,161	4,067,460
Vehicle Sales (Units)	85,3422,995	87,400,384	91,458,490	92,655,973	91,906,886
Green Vehicle Sales (%)	2	2	3	3	4

Source: Ministry of International Trade and Industry (2020).

Table 4: Comparison between Total ASEAN Green Vehicle and Vehicle Sales

Year	2014	2015	2016	2017	2018
Green Vehicle Sales (Units)	829,103	907,392	963,645	1,068,340	1,147,430
Vehicle Sales (Units)	3,190,208	3,070,488	3,164,742	3,339,693	3,561,830
Green Vehicle Sales (%)	26	30	30	32	32

Source: Ministry of International Trade and Industry (2020).

Vehicles are divided into two categories which are traditional combustion engines and new energy vehicles (Tu & Yang, 2019). Vehicles that do not rely on gasoline and diesel sources are referred to as new energy vehicles, including, fuel-efficient vehicles (FCV), alternative fuel vehicles (AFV) and flexible fuel vehicles (FFV) as new energy vehicles, including hybrid electric vehicles (HEV) and electric vehicles (EV). This study only focuses on hybrid electric vehicles (HEV) and electric vehicles (EV) to explore the key factors influencing consumers' acceptance of green vehicles to improve the penetration of green vehicles in the Malaysian market and provide relevant suggestions for future researchers.

1.1. Malaysia Automotive Industry

Due to their affordability and convenience, Malaysians have utilised motor vehicles for daily commuting for the last three decades, resulting in a rapid increase in registered motor vehicles on the road (Mohamad & Kiggundu, 2007). Malaysia's urbanisation has accelerated and increased motor vehicle demand (Mohamad & Kiggundu, 2007). Despite optimistic growth, car ownership and use have increased environmental pollution (Hao, et al., 2016). From 2019, vehicle increased one million annually (Chan, 2022). In 2020, total industry volume (TIV) is expected to rise 0.5% to 607,000 units from 604,287 units in 2019 (Nee, 2020). Commercial vehicles dropped by 17.4% due to the 2019 economy slowdown and project delays (Nee, 2020). Table 5 displays the passenger and commercial vehicle industries and production volumes. TIV and TPV have also increased since 2017. The June–September 2018 tax holiday may have boosted sales (Ministry of International Trade and Industry, 2020).

Table 5: Total Industry Volume (TIV) and Total Production Volume (TPV) for Passenger and Commercial Vehicles

Year	2014	2015	2016	2017	2018
Industry Volume (Units)	666,465	666,674	580,124	576,635	598,714
Production Volume (Units)	596,418	614,664	545,253	499,639	564,971

Source: Ministry of International Trade and Industry (2020).

On the other hand, passenger vehicles had increased 3.2% due to the stable employment market, aggressive sales campaigns, new car models being introduced at competitive prices as well as attractive offers for consumers (Nee, 2020). Malaysian Automotive Association forecasts the growth of total vehicles for the next four years include 2% growth in 2021, 2.1% in 2020, 2.2% in 2023 and 2.3% in 2024 (Nee, 2020). Table 6 shows the total sales and market share for the top 10 vehicle brands in Malaysia.

Table 6: Total sales and market share for top 10 vehicle brands in Malaysia

Brands	Total Sales			Market Share	
	Q1 2020 (Units)	Q1 2019 (Units)	Difference (%)	Q1 2020 (%)	Q1 2019 (%)
Perodua	44,977	60,659	-25.85	42.30	43.40
Proton	21,757	18,281	19.01	20.40	12.80
Honda	11,100	22,190	-49.98	10.40	15.50
Toyota	10,415	13,722	-24.10	9.80	9.60
Nissan	2,747	5,166	-46.83	2.60	3.60
Mazda	2,723	3,311	-17.76	2.60	2.30
Mitsubishi	1,765	2,273	-22.35	1.70	1.60
BMW	1,600	2,565	-37.62	1.50	1.80
Isuzu	1,576	1,904	-17.23	1.50	1.30
Mercedes	1,342	3,018	-55.53	1.30	2.10

Source: Lee (2020).

From 33,325 in 2014 to 64,839 in 2018, the automobile manufacturing and aftermarket sector added engineers, designers, data analysts, techs, and specialists to Malaysia's capacity (Ministry of International Trade and Industry, 2020). CBU unit exports rose from 1.5 billion in 2014 to 2.08 billion in 2018 while vehicle parts and components exports rose from 4.7 billion to 12.1 billion due to premium model exports (Ministry of International Trade and Industry, 2020).

1.2. Green Vehicle Trends in Malaysia

The Ministry of Transport (2016) estimated that Malaysia's transportation sector consumes 35% (over-indexed vs. global 23%) of national energy. Malaysia's private car ownership accounts for 59% of CO2 emissions. Without government intervention, energy and carbon monoxide reduction will remain difficult. The ministry and private organisations must reduce externalities, and switching from fossil fuels to green technology is desirable and feasible for all stakeholders. Due to increased energy demand and the need to reconsider fossil fuel consumption in the transportation sector, Malaysia became a net importer of crude oil and petroleum products (Kok, 2015).

Energy-Efficient Vehicles (EEV) are hybrids, electric vehicles, and alternatively fuelled vehicles like CNG, LPG, Biodiesel, Ethanol, Hydrogen, and Fuel Cell that meet certain carbon emissions (g/km) and fuel consumption (l/100 km) standards (Shah, 2014). Thus, it encompasses gasoline, diesel and hybrid car technologies. Under the EEV umbrella, even alternative and future technologies (EVs, hydrogen, and fuel cells) are covered. Table 7 shows the energy-efficient vehicle specifications of cars in Malaysia.

Table 7: Energy Efficient Vehicles Specification for Car

Segment	Description	Curb Weight (KG)	Fuel Efficiency (L/100KM)
A	Micro Car	< 800	4.50
	City Car	801 – 1,000	5.00
B	Super Mini Car	1,001 – 1,250	6.00
C	Small Family Car	1,251 – 1,400	6.50
D	Large Family Car	1,401 – 1,550	7.00
	Compact Executive Car	1,401 – 1,550	7.00
E	Executive Car	1,550 – 1,800	9.50
F	Luxury Car	1,801 – 2,050	11.00
J	Large 4x4	2,051 – 2,350	11.50
Others	Others	2,351 – 2,500	12.00

Source: Shah (2014).

Since the implementation of NAP 2014, the percentage of energy-efficient vehicles has been steadily increasing year after year. Table 8 illustrates the volume and penetration of energy-efficient vehicles from 2014 to 2018. Malaysia's government has encouraged consumers to buy green vehicles by offering electric vehicle buyers a 50% road tax reduction (Lim, 2019). Since 31 March 2019, 5,403 electric cars and 46,981 plug-in hybrid vehicles have been registered, with Selangor having the most at 2,791 and Federal Territory the most at 25,360 (Lim, 2019).

Table 8: Energy Efficient Vehicle (EEV) Volume and Penetration from 2014 to 2018

Year	2014	2015	2016	2017	2018
EEV Volume (Units)	93,975	213,336	248,293	299,850	339,978
EEV Penetration (%)	14	33	43	52	62

Source: Ministry of International Trade and Industry (2020).

1.3. National Automotive Policy 2020

In February 2020, the National Automotive Policy (NAP) 2020 was launched to make the country a digital industrial revolution leader in automotive manufacturing, engineering, and technology.

From 2020 to 2030, the programme promoted new technology research, business and job creation, and manufacturing processes and value chains in the local automotive and mobility sectors. NAP 2020 has three strategic thrusts and three strategies for 2030. The plan will focus on Next-Generation Vehicles (NxGVs), Mobility as a Service (MaaS), and Industry 4.0, developing Automated, Autonomous, Connected Vehicles (AACV), lightweight material technologies, hybrid, electric, and fuel cell vehicles (Ministry of International Trade and Industry, 2020).

The personalised incentive mechanism will remain based on investors' cost-benefit analyses of specific company proposals. These customised incentives will be more comprehensive, encompassing not only EEVs but also NxGVs, essential components, and testing centres. Market expansion will also be pursued, with measures to boost export growth for vehicles, components, aftermarket, and services (Ministry of International Trade and Industry, 2020).

Strategy will focus on improving the domestic value chain's competitiveness by pursuing high-quality technology goods for future car manufacturers and consumers. Second, local talent will be developed to meet future automotive and transportation technology needs. Safety, environment, and consumer concerns will be the third strategy. To address the issue of emissions, more environmentally friendly parts of technology are expected to be introduced, while the emphasis on vehicle safety will increase. New consumer rights protections for spare parts and services like maintenance and recall will also be included (Ministry of International Trade and Industry, 2020).

1.4. Research Purpose and Contribution

Green vehicles are a promising way to reduce fossil fuel use, carbon dioxide, and greenhouse gas emissions, but Malaysian consumers are still unfamiliar with them (Adnan et al., 2017). Information exchange gives consumers more choices when making purchases, and their preferences vary (Chiang, 2014). Green vehicles are becoming more popular, but their market share is still low (Tu & Yang, 2019). Malaysia needs zero-emission mobility for industry and consumers. As such, this study aims to investigate the factors influencing consumers' acceptance of green vehicles in light of ongoing environmental issues. This study also reviewed consumer preferences for green vehicles to inform policymakers and to apprise green vehicle design, development and advise companies on green vehicle sales. Additionally, this research also identified research gaps, limitations, and future research opportunities.

2. LITERATURE REVIEW

The emphasis of this research was to find the relationship between the variables in the Cognitive Affective Model (CAM) model like perceived value, perceived quality and external factors in influencing consumers' acceptance towards green vehicles that are sold in Malaysia. Four hypotheses were formed to assess the relationship between the four variables and the acceptance of green vehicles from different aspects.

2.1. Perceived Value (Environmental Concern)

Environmental concern is the personal desire to protect the environment by using green products. Green products are becoming popular as consumers become more environmentally conscious (Mei

et al., 2012). Chang (2011) noted that consumers may be ambivalent about green products because they weigh the pros and cons. Diamond (2009) also suggested that high adoption costs and lack of knowledge by potential adopters are common barriers to using new technologies, including green technologies. Syed and Mishra (2016) also stated that informed consumers drive the need to adopt green technologies.

H1: Environmental concerns will affect consumers' acceptance of green vehicles in Malaysia.

2.2. Perceived Value (Acquisition and Maintenance Cost)

Acquisition cost is the price a consumer pays to buy a product or service, and maintenance cost is the price to keep the product working. Zeithaml (1988) defined price as the consumer's opportunity cost for acquiring a product or service. Mahmood (2017) stated that market supply and demand determine prices. The study also suggested considering a consumer's willingness to pay. Price, not products, promotion, or distribution, generates revenue for a business (Kotler & Keller, 2016). Lane and Potter (2007) stated that high purchase prices, high maintenance costs, and long payback times are barriers to entry and negatively impact purchase decisions. Barton and Schutte (2017) stated that high premium prices, safety concerns, and low supply due to unproven technology are barriers to new technology adoption.

H2: Acquisition and maintenance costs will affect consumers' acceptance of green vehicles in Malaysia.

2.3. Perceived Quality (Vehicle Performance)

Despite most consumers are pro-environmental, they still care about vehicle performance, especially design, power, and comfort (Ioncica et al., 2012). Ozaki and Sevastyanova (2011) stated that consumers' experience and emotional attachment to vehicle performance will influence their purchase decision and the type of vehicle they buy. Jayaraman et al. (2015) added that drivers may make an emotional purchase decision based on vehicle performance, so a good driving experience may take precedence over other factors. This suggests that vehicle performance affects consumer acceptance of green cars.

H3: Perceived quality (vehicle performance) will affect consumers' acceptance of green vehicles in Malaysia.

2.4. External Factor (Government Policies on Economic Incentive)

Malaysia wanted to compete with Thailand by creating a green vehicle marketing hub due to green vehicles' commercial and environmental potential (Harman, 2017). Subsidies and tax exemptions for consumers and automakers may help green vehicles catch on. Infrastructure development, modernization, and environmental education can also boost green vehicle adoption (Jiang, 2016). Beresteanu and Li (2011) found that higher fuel prices and federal income taxes increased the market share of hybrid and electric vehicles in exchange for environmental preservation.

H4: External factors (government policies) will affect consumers acceptance of green vehicles in Malaysia.

3. METHODOLOGY

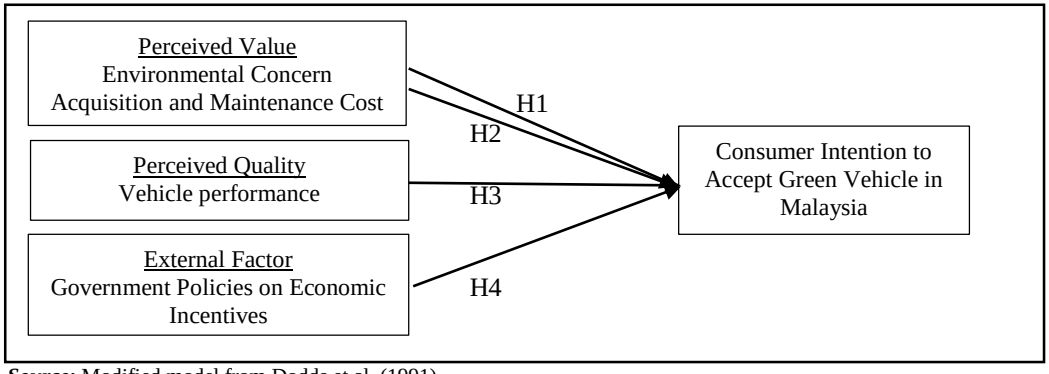
3.1. Conceptual Framework

Since the green vehicle is a new type of passenger vehicle with green technology, consumer behaviour in accepting green vehicles will be regarded as their innovative behavior. One of the relevant theories to be used for this research is the Cognitive Affective Model (CAM), as the model can explain consumers' level of acceptance and be used to predict a wide range of consumer behavioural attributes. CAM is also able to emphasise environmentally significant behaviour and the internal and external stimuli of the consumer. Figure 1 exhibits the adopted CAM model that hypothesises three independent variables such as perceived value, perceived quality, and the influence of external factors on consumer acceptance towards green vehicles in Malaysia.

According to Cohen and Areni (1991), an effective response motivates some cognitive responses because buyers use cognitive reactions to validate their preference. Thus, if a customer likes an item, they may justify their preference by thinking it's high-quality or cost-effective. Affective response also affects buyers' purchasing intention and cognitive reaction. The "affective" part of purchase intentions is as important as the cognitive part. However, such important criteria have been ignored lately in purchase intention research (Li, Monroe, & Chan, 1984).

In this study, perceived value evaluates consumers' concerns over environmental issues and buyers' perceptions towards the acquisition of green vehicles and relevant maintenance costs. As for perceived quality, this attribute refers to vehicle performance. The external factor consists of consumer perceptions towards government policies that make up the last variable in this model. Therefore, the research architecture of this study is shown in Figure 1, and the operational definition of each variable and reference are shown in Table 9.

Figure 1: Conceptual Framework of Cognitive Affective Model with Application towards Intention to Accept Green Vehicle among Consumers in Malaysia



Source: Modified model from Dodds et al. (1991).

Table 9: Operational Definition and Reference

Research Variables	Operability Definition	Authors
Perceived Value (Environmental Concern)	Consumers concerns about air pollution and the environment	Axsen and Kurani (2013) Noppers et al. (2014)
Perceived Value (Acquisition and Maintenance Cost)	Consumers concern about the purchasing cost, fuel cost, total cost, financial benefit.	Hoen and Koetse (2014) Graham-Rowe et al. (2012)
Perceived Quality (Vehicle Performance)	Consumers concern about the vehicle's performance, speed, noise, look and style.	Sang and Bekhet (2015)
External Factor (Government Policies on Economic Incentive)	Consumer concern about economic incentives, subsidy policy, government incentives or cost-reduction policy.	Helveston et al. (2015) Beck et al. (2016)

3.2. Sampling Design and Questionnaire Development

The study design approach focuses on empirical research where essential data and information are collected using the 25-item self-administered questionnaires which incorporate four main constructs of CAM. A five-point Likert scale ranging from 'Strongly Agree' to 'Strongly Disagree' was used to measure consumer's level of acceptance. The questionnaire consists of five parts and is composed of statements that address and measure CAM.

This research aims at consumers who need a vehicle for daily usage and respondents were selected using purposive sampling. Purposive sampling was relevant as this research required as there is no list of the consumer sampling frames (Seddon, 2014) and the consumers who are currently owning a vehicle will be selected as one of the respondents. Lee (2017) reports that Selangor State and Federal Territory have the highest vehicle registration with 42% of passenger car ownership coming from these two states. As such, samples are drawn from these two states given their high car purchase and registration. Filtering question was used to determine the eligibility of the respondents before proceeding with the survey. Exploratory factor analysis (EFA) and structural equation modelling (SEM) were the key factors in establishing the sample size. According to Tabachnick and Fidell (2001), a sample size of at least 300 is required for explanatory factor analysis. Furthermore, Hair et al. (1998) proposed that for SEM, a reasonably large sample size of 200 and above should be used. According to Comrey and Lee (1992), the sufficient sample size for SEM can be assessed on a scale of 50-very poor, 100-poor, 200-fair, 300-good, 500-very good, and 1000 or more-excellent. Therefore, a total of 700 questionnaires were distributed and 606 responses were returned completely for further data analyses, whereby achieving a response rate of 86%.

3.3. Method of Analysis

Quantitative assessments which consist of descriptive analysis, reliability test, EFA and SEM were conducted on the collected data by using SPSS and AMOS. The study used Cronbach's Alpha to determine the internal consistency and is considered as a measure of scale reliability (UCLA Statistical Consulting Group, 2017). The demographic profile of the respondents was generated using descriptive analysis. At the same time, EFA was required to discover the latent factors that might influence consumers' acceptance of green vehicles. Yong and Pearce (2013) stated that EFA will assist in segmenting similar variables into fewer latent themes in simplifying the number of

variables and help in predictive regression models. Confirmatory factor analysis (CFA) was then performed after EFA to confirm the factor structure and structural equation modelling (SEM) was used to specify how each construct was related to one another (Hair et al., 2013).

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistic

From Table 10, 606 respondents have been identified from the data, with 50% male and 50% female respondents. 39.6% of respondents are 25–34 years old. 31.85% of respondents are 35–44 years old, followed by 17.16% who are 45–54 and above 55. 5.12% are under 24. 54.95% are degree holders, followed by 27.06% of Master or PhD holders. Diploma holders comprise 12.87% and secondary school dropouts 5.12%. 27.56% of respondents earn over RM10,000 per month, followed by 21.62% who earn RM4001–RM6000. Earning below RM4000 is 18.15%, RM6001–RM8000 is 16.83%, and RM8001–RM10000 is 15.84%. Surprisingly, only 11.2% of consumers own a green vehicle and 7.2% are unaware of their existence.

Table 10: Demographic Profiles of Respondents

Demographic Variables	Description	Percentage (%)
Gender	Female	50.00
	Male	50.00
Age	Below 24	5.12
	25-34	39.60
	35-44	31.85
	45-54	17.16
	55 and above	6.27
Education level	Secondary School and below	5.12
	Diploma	12.87
	Bachelor's degree	54.95
	Master's degree and PhD	27.06
Income	Below RM 4,000	18.15
	RM 4,001- RM 6,000	21.62
	RM 6,001- RM 8,000	16.83
	RM 8,001- RM 10,000	15.84
	RM 10,001 and above	27.56
Are you currently owning a green vehicle?	Yes	11.30
	No	88.80
Are you aware of green vehicles such as EVs and HEVs?	Yes	92.80
	No	7.20

4.2. Exploratory Factor Analysis

Exploratory factor analysis is relevant for uncovering the latent factors that impact the respondents' acceptance of green vehicles. There were 18 statements with a five-point Likert scale and these statements are generated from variables in CAM namely perceived quality, perceived value, external factor and intention to accept green vehicles. Out of the 18 statements, only 15 statements are relevant and related to the acceptance. To evaluate factor analysis, the Kaiser-Meyer-Olkin

(KMO) test of sampling adequacy and Barlett's test of sphericity were needed. The KMO value is 0.847 (Hutcheson & Sofroniou, 1999) and Bartlett's test of sphericity is significant at $p<0.01$ (Field, 2013), allowing factor analysis for the 18 statements.

The varimax rotation and factor loading were generated and exhibit in Table 11. Based on the results, items with a factor loading of 0.5 and more are considered significant items. The range of the factor loadings for the five factors is from 0.576 to 0.877. These factors were named according to the sub-variables that fell within each factor. The total variance for the five latent factors is 71.53 per cent and communalities value for each item is all above 50 percent (Field, 2013) and the first-factor variance is 19.916 percent which is less than 50 percent (Podsakoff & Organ, 1986) as indicated below:

Table 11: Results of Exploratory Factor Analysis

	Items	**Factor Loading**				
		F1	**F2**	**F3**	**F4**	**F5**
Consumers' Acceptance						
INT2	I will consider buying a green automobile if it is easy for me to access the dealer.	0.824				
INT4	I intend to accept green automobile if the after-sales services is widely available nationwide.	0.794				
INT3	I intend to accept green automobile because it makes me easy to follow my lifestyle.	0.768				
INT1	I plan to accept green automobiles in the near future because I feel safer driving them.	0.751				
	Variance (per cent of explained)	19.916				
Perceived Quality						
PQP3	The green automobile has a quality audio system.		0.822			
PQP2	The green automobile is more comfortable.		0.779			
PQP4	The green automobile has better acceleration.		0.737			
	Variance (per cent of explained)		15.389			
Perceived Value (Environmental Concern)						
PVENV3	I am concerned for the environment in the long term, and this plays a part in choosing my next vehicle.			0.734		
PVENV4	I believe I would play a part in reducing carbon emissions by owning and using a green vehicle.			0.693		
PVENV2	I believe the green automobile is more concerned about emissions which make them environmentally friendly.			0.649		
PVENV1	Air conditioning systems in the green automobile can hold well in these days of global warming.			0.576		
	Variance (per cent of explained)			13.620		

Table 11: continued

External Factor (Government Policies on Economic Incentives)			
GOV1	NAP2014 promotes HEV	0.877	
GOV2	NAP2014 encourages HEV acceptance	0.852	
	Variance (per cent of explained)	11.913	
Perceived Value (Acquisition and Maintenance Cost)			
PV4	The price of a car is the main determinant factor when selecting a car.		0.837
PV3	The maintenance cost for a green automobile is expensive.		0.793
	Variance (per cent of explained)		10.693
	Total Percentage of Variance		71.53

Cronbach's Alpha score is required to determine the internal reliability consistency among the variables. Based on the result exhibited in Table 12, the five latent factors indicated sufficient internal reliability consistency since the score for each factor was greater than 0.6.

Table 12: Results of Reliability Analysis

Dimensions	Cronbach's Alpha
Consumers' Acceptance	0.873
Perceived Quality	0.833
Perceived Value (Environmental Concern)	0.711
External Factor (Government Policies)	0.843
Perceived Value (Acquisition and Maintenance Cost)	0.649

4.3. Measurement Model

This study followed Anderson and Gerbing (1988) suggestion by adopting a two-step approach of SEM when estimating measurement and the structural model. Construct reliability and convergent validity were examined at the first step by using CFA and path effects and their significance in the structural model were examined at the second step. Maximum likelihood estimation (MLE) such as factor loading, reliability, convergent and discriminant validity were assessed while constructing the measurement model. Table 13 reports a summary of standardized regression weight (factor loading), skew, kurtosis, Cronbach alpha, Composite reliability and average variance extracted (AVE).

4.3.1. Construct Reliability and Indicator Reliability

PVENV1 and PVENV2 are the only standardised regression weights below 0.5 in this study. PVENV 1 and 2 were removed from the construct because their standardised regression weights were below 0.40, indicating they had little in common (Hair et al., 2013). PVENV1 and PVENV2 were removed from the scale to improve CR and AVE. Hair et al. (2013) found that indicators with high loadings share many characteristics. Loading of 0.5 is acceptable, but indicators with loadings below 0.40 must be removed from the scale, while those from 0.4 to 0.7 should be eliminated only if they improve the CR or average variance extracted (AVE) (Hair et al., 2011; Hair et al., 2010). The loadings ranged from 0.557 to 0.887, exceeding the recommended value of 0.5 (Hair et al., 2010), so all items met the requirements without elimination. Table 9 shows that all four constructs

were error-free because Cronbach alpha (0.692–0.873) and composite reliability (CR) (0.817–0.958) were above 0.6. (Kannana & Tan, 2005).

4.3.2. Convergent Validity

AVE is a measurement used to determine convergent validity. Each of the construct items is considered to contain more errors if the AVE value is below 0.5 (Hair et al., 2013). The full model construct is fulfilled in this study since the AVE values for Perceived Quality (Vehicle performance) (0.635), Perceived Value (Environmental Concern) (0.542), External Factor (Government Policies on Economic Incentives) (0.732), Perceived Value (Acquisition and Maintenance Cost) (0.527) and consumer acceptance (0.635) are all within the acceptable range (>0.50) (Table 13).

Table 13: Result of Measurement Model

Item Code	Standardized Regression Weight (Factor loading)	Skew	Kurtosis	Cronbach Alpha	CR	AVE
Consumers' Acceptance				0.873	0.958	0.635
INT1	0.776	-0.599	0.350			
INT2	0.825	-0.434	-0.232			
INT3	0.786	-0.942	1.098			
INT4	0.797	-0.402	-0.017			
Perceived Quality				0.833	0.922	0.635
PQP2	0.763	-0.472	-0.283			
PQP3	0.865	-0.287	-0.274			
PQP4	0.757	-0.501	0.048			
Perceived Value (Environmental Concern)				0.692	0.823	0.542
PVENV3	0.661	-1.344	2.555			
PVENV4	0.805	-0.953	1.093			
External Factor (Government Policies on Economic Incentives)				0.843	0.817	0.732
GOV1	0.822	-0.613	0.102			
GOV2	0.887					
Perceived Value (Acquisition and Maintenance Cost)				0.649	0.868	0.527
PV3	0.862	-0.571	0.136			
PV4	0.557	-0.245	-0.310			

4.3.3. Discriminant Validity

Based on Table 14, the construct for this study was considered distinctive but correlated with one another since the AVEs value is higher than the SICs value. There are no multi-correlation issues for this study as the value for each pair of the latent exogenous construct is less than 0.85.

Table 14: Discriminant Validity

			Innerconstruct Correlations	Squared Interconstruct Correlations (SIC)	Support (AVE > SIC)
Acceptance	<-->	Perceived Quality	0.588	0.346	Yes
Acceptance	<-->	Environmental Concern	0.496	0.246	Yes
Acceptance	<-->	External Factor	0.540	0.292	Yes
Acceptance	<-->	Acquisition and Maintenance Cost	0.078	0.006	Yes
Perceived Quality	<-->	Environmental Concern	0.603	0.363	Yes
Perceived Quality	<-->	External Factor	0.413	0.171	Yes
Perceived Quality	<-->	Acquisition and Maintenance Cost	0.374	0.139	Yes
External Factor	<-->	Environmental Concern	0.327	0.107	Yes
Acquisition and Maintenance Cost	<-->	Environmental Concern	0.353	0.125	Yes
External Factor	<-->	Acquisition and Maintenance Cost	0.088	0.007	Yes

4.4. Structural Model Analysis

The model fit indicators show whether the sample data fit the structural equation model. As suggested by Hair et al., (2010), absolute fit, parsimonious fit and incremental fit measures are used in this study and before explaining the relationship of each construct, a minimum of using one fitness index from each measure is needed. Table 15 presents the goodness-of-fit indices as well as the recommended threshold. The model fit indicators satisfied the independent level of the recommended threshold; thus, the proposed model has a good fit for this study.

Table 15: Goodness-of-Fit Indices

Name of Category	Name of Index	Adequate of Model Fit	Result	Fit (Yes / No)
Absolute Fit Measure	GFI	> 0.90	0.957	Yes
	AGFI	> 0.90	0.929	Yes
	RMSEA	< 0.08	0.062	Yes
	SRMR	< 0.08	0.039	Yes
Incremental Fit Measure	NFI	> 0.90	0.948	Yes
	CFI	> 0.90	0.963	Yes
	TLI	> 0.90	0.947	Yes
	IFI	> 0.90	0.963	Yes
Parsimonious Fit Measure	Chisq/df	1.00-5.00	3.323	Yes
	PGFI	> 0.50	0.578	Yes
	PNFI	> 0.50	0.668	Yes

Notes: df, degree of freedom; CFI, comparative-fit-index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; GFI, goodness-of-fit; NFI, normed fit index; AGFI, adjusted goodness-of-fit index; IFI, the increment fit index; TLI, Tucker-Lewis coefficient index; PNFI, parsimony normed fit index.

4.5. Hypothesis Explanation

The study aims to confirm the theoretical framework that can be used in the Malaysian context in identifying the key factors influencing consumers' acceptance of green vehicles through SEM and provide reference design suggestions to the automotive industry. The result of hypothesis testing is shown in Table 16 and figure 2 shows the relationships between the variables in the structural model. The study shows that all of the hypotheses were significant.

Figure 2: Research Structure Pattern Diagram

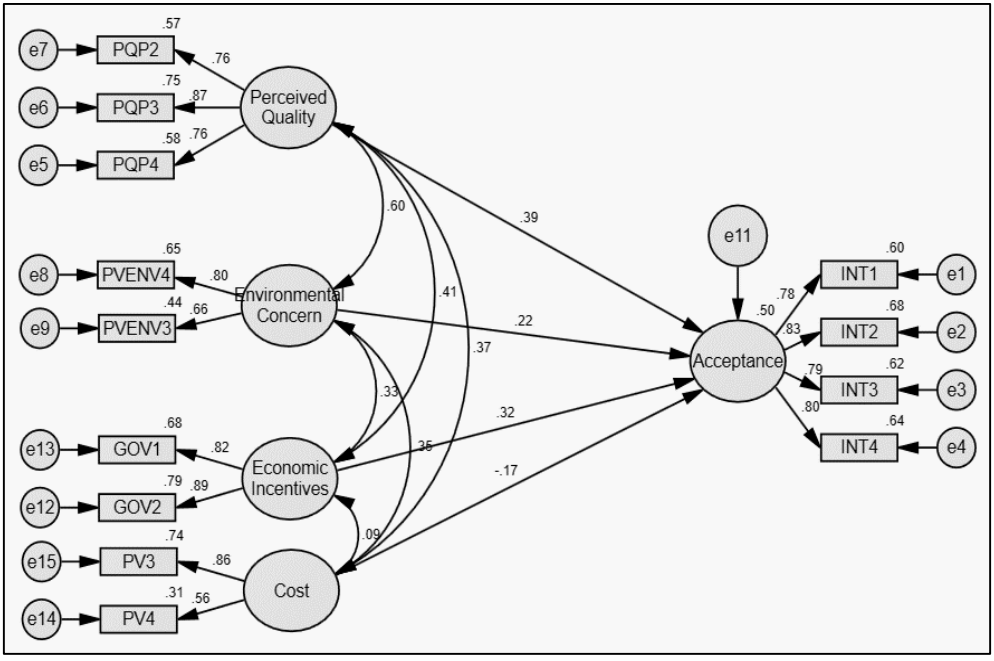


Table 16: Structural Path Analysis Result

Hypotheses		β	S.E.	C.R. (t-value)	Result
H1	Environmental concern has a significant positive impact on consumers acceptance of green vehicles in Malaysia.	0.212	0.060	3.539***	Valid
H2	Acquisition and maintenance cost has a significant negative impact on consumers acceptance of green vehicles in Malaysia.	-0.208	0.056	-3.677***	Valid
H3	Perceived quality (vehicle performance) has a significant positive impact on consumers acceptance of green vehicles in Malaysia.	0.370	0.058	6.403***	Valid
H4	External factor (government policies) has a significant positive impact on consumers acceptance of green vehicles in Malaysia.	0.266	0.038	6.978***	Valid

Notes: *** means significant at 0.01.

As shown in Table 16, the research hypothesis H1 is supported ($p<0.01$) in this study. The perceived value (environmental concern) has a β value of 0.212 which indicates that environmental concern is one of the main predicting constructs for this model. Hong et al. (2013) found that pro-environmentalism drives green vehicle adoption due to their high mileage and low carbon emissions. According to Heutel and Muehlegger (2015), environmentalists adopt green technologies because of environmental concerns. Nevertheless, a pro-environmental attitude does have a positive impact on accepting green technologies (Adnan et al., 2017).

For hypothesis H2, the perceived value (acquisition and maintenance costs) exhibits a negative impact ($\beta=-0.208$) compared to other constructs. Malaysians will only buy green cars if they're affordable and a product priced above its perceived value will not sell. Most consumers are rational and expect to maximise their value, so demand is dependent on the extra money spent to maximise product satisfaction (Ampofo, 2014). East, Wright, and Vanhuele (2013) noted that price consciousness affects consumer acceptance of a product. This is supported by Mamun et al. (2014) study which indicated that product price affects consumer acceptance and purchase intention as perceived price increases consumer monetary loss.

In addition, the research hypothesis H3 is supported ($p<0.01$) where it indicated that perceived quality based on vehicle performance ($\beta=0.370$) has a significant positive influence on consumers' acceptance of green vehicles. Perceived quality differentiates vehicle brands from one another and provides consumer with a reason to purchase a vehicle (Asshidin et al., 2016). Top-quality features will attract customers, and this will influence consumer purchase of the vehicle with qualities like power, acceleration, road handling, design, pleasant driving experience and adequate safety features (Bennett et al., 2016).

Lastly, the research hypothesis H4 is supported ($\beta=0.246$, $p< 0.001$) in this study which indicated that government policies such as economic incentives can influence consumers' acceptance and buying behaviour. Gallagher and Muehlegger (2011) stated that consumers will accept and purchase a green vehicle if the fuel price is economical with supportive government incentives. In Malaysia, the provision of low corporate and manufacturing taxes for 10 years serves as a distinctive incentive to promote the adoption of HEV (Adnan et al., 2017) and this helps in the acceptance of green vehicles.

5. CONCLUSION

The consumption of fossil fuels over the years has created greenhouse effects, as the gas emissions from conventional vehicles have affected air quality and environmental sustainability, especially in urban areas. Such externalities created the rationale for conducting this research to discover the prospect of alternative energy vehicles replacing conventional combustion engine vehicles in the effort of reducing GHG emissions. The focus of this research is primarily on the intention of Malaysian consumers to accept green vehicles as their mode of transportation.

Environmental concern was one of the main variables in CAM that positively influenced Malaysian consumers' acceptance of green vehicles. The straightforward promotional efforts focusing on long-term cost savings through fuel consumption reduction and an environmentally friendly campaign indicated the relevance of environmental concern. Thus, automakers should emphasise

the campaign's central message that consumers can reduce carbon emissions by switching to green vehicles. Automakers must also ensure that switching to green vehicles won't ruin the driving experience. Schools should instil environmental values and encourage children to use green products.

To promote green vehicles in Malaysia, the new National Automotive Policy should focus on infrastructure and EEV manufacturing. Tax exemption incentives for local and international car assemblers were a smart move by the Malaysian government. Replacement parts like batteries and motors for green vehicles are expensive if taxes are included. To add value, price-sensitive consumers should receive tax exemptions. Public locations like hospitals and train stations should provide green vehicle charging stations and service facilities. Such efforts will boost post-MCO car sales and green vehicle adoption.

Consumers still prefer vehicles with joy to drive, safety, silence, gearless operation, comfort, ease of drive, and good acceleration, despite the importance of environmental concern. Green car manufacturers should offer a pleasant driving experience while developing technologies to reduce environmental impact. The brand with the best performance and driving experience will lead the market to green vehicles. Consumers prefer experiential car features that satisfy their needs and provide unique sensory experiences (Dubois & Ruvio, 2014). Current vehicles are lacking from a consumption dynamics perspective. Thus, green vehicles may be more appealing if marketed as "experiential luxury" rather than "materialistic luxury."

Future research should examine how consumers' socio-demographic profiles affect green vehicle acceptance to better segment and target markets. Dyson, Byton, and Ford are entering the electric vehicle market, while Mercedes, BMW, Tesla, and Volkswagen are investing in vehicle technology. Thus, a more detailed comparison of brand images may reveal consumers' green vehicle preferences. Finally, this study and other potential findings provide market-oriented inputs to achieve NAP 2020's 25% RE generation capacity by 2025 (Ministry of International Trade and Industry, 2020).

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