The Mediating Effect of Buyers' Confidence Attitude on the Relationship Between Buyers' Perception of Product Cost-Benefit, Product Compatibility, and Government Tax and Subsidies Towards Sustainable Adoption of Electric Vehicles in Malaysia

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DOI: https://dx.doi.org/10.47772/IJRISS.2026.10200576

Received: 18 January 2026; Accepted: 23 January 2026; Published: 21 March 2026

ABSTRACT

The electric vehicle industry in Malaysia constitutes approximately 80% of total industry output, reflecting its growing significance as the country moves toward achieving carbon neutrality by 2050. This paper investigates buyers' adoption of the electric vehicle industry in Malaysia by examining the perception of product cost-benefit, product compatibility, government tax policies and incentives by incorporating the buyers' confidence attitude as a mediator. A quantitative cross-sectional approach was applied using data gathered from survey questionnaires from employed Malaysians aged 21 and above, with a minimum sample size of 384 respondents. Data analysis was conducted using Structural Equation Modeling (SEM)-AMOS, to validate the constructs. The study is expected to show the mediating effect of buyers' confidence attitude between factors influence buyers' adoption on electric vehicle in Malaysia. Grounded in Diffusion of Innovation theory, the findings offer practical insights for policymakers and industry stakeholders to enhance electric vehicle adoption and industry long-term sustainability.

Keywords: Electric vehicles, Buyer confidence, Sustainable adoption, Government support, Product price, and compatibility

Background of Study

Malaysia is committing in achieving zero emissions by the year 2050. For that reason (meeting emission reduction targets and boost country's energy transition), Malaysia is now focusing on the production or bringing the electric vehicle corporations in the country. Based on the National Energy Transition Roadmap, Malaysia sets a target for electric vehicles to represent up to 80% of the industrial total production by 2050. This goal aligns with the foundation laid by both the National Energy Policy 2022-2040 and the Low Carbon Mobility Blueprint 2021-2023. Referring to the New Industrial Master Plan 2030, Malaysia is focusing on transforming its industrial sector to align with strategic investment and industrial objectives outlined in the National Investment Aspirations. In this case, Perusahaan Otomobil Kedua Sendirian Berhad (PERODUA) has been selected as the domestic electric vehicle's producer, achieving the national electric vehicle innovation. With the support and incentive from the government, the local automotive industry is targeted to increase the production of cars including the EV to 15% from industry total production in 2030 (Bernama, 2023).

Electric vehicle industry in Malaysia has seen a dramatic changes for the past ten years. Data in Table 1 shows the total registration of electric vehicles for 10 years. Looking at the trend, the number of electric cars registered in 2010 is nil, however, show gradual increase for the incoming years. The peak occurred in 2017 in which 348 number of electric vehicles were registered before decrease to 184 unit and 185 unit respectively in 2018 and 2019.

Table 1: Registration of Electric Vehicle from 2010-2019

Year	Cars	Total
2010	0	0
2011	6	275
2012	26	183
2013	14	157
2014	27	291
2015	55	130
2016	32	50
2017	25	348
2018	4	184
2019	5	185

Source: https://archive.data.gov.my

Table 2 illustrates moderate growth in the number of electric vehicles manufactured by Chinese EV manufacturers, as evidenced by those manufacturers having the majority of the top spots in this table. The majority of EV sales in Malaysia were by BYD, selling 8417 units, followed by Proton with 6212 units sold due to the increasing number of Local EV Sales. According to the sales records, Tesla has moved up to the third spot for EV Sales with 3847 Units sold due to sales growth in May. The luxury segment is represented by BMW, Xpeng, and Zeekr, which have achieved consistent sales in the range of 900 to 1200 units sold over the last nine months. The mid-segment is represented by Porsche and Mercedes-Benz, Denza and Chery, which also experienced consistent growth in the range of 500 to 850 units sold each month. Leapmotor and Great Wall Motor, smart and Neta had limited Market Shares, yet still maintained a loyal customer base. The data has indicated that Hyundai, Dongfeng, and Honda have been less successful in the Malaysian EV Market due to Limited Product Offerings and Slow Expansion. The Malaysian Market is showing an increasing amount of interest in the new Chinese Electric Vehicle Manufacturers, and consumers are becoming more willing to adopt Electric Vehicles.

Table 2: Top 20 Best-Selling EV Brands in Malaysia (Jan–Sept 2025)

No.	**Model**	**Jan 2025**	**Feb 2025**	**Mar 2025**	**Apr 2025**	**May 2025**	**June 2025**	**July 2025**	**Aug 2025**	**Sept 2025**	**Total**
1	BYD	505	634	1,020	1,048	1,148	1,045	870	1,119	1,028	**8,417**
2	Proton	421	580	737	799	862	604	686	766	757	**6,212**
3	Tesla	13	443	171	108	1,075	587	256	509	685	**3,847**
4	BMW	230	81	157	119	179	136	119	96	98	**1,215**
5	Xpeng	81	74	72	153	125	132	109	96	137	**979**

6	Zeekr	101	11	157	91	105	65	61	88	293	**972**
7	Denza	–	34	204	157	129	91	103	69	63	**850**
8	Chery	12	10	26	44	116	186	59	41	60	**554**
9	Porsche	38	51	74	45	68	83	49	59	78	**545**
10	Mercedes-Benz	35	26	28	40	43	35	59	261	15	**542**
11	MINI	34	40	46	34	73	78	65	54	44	**468**
12	MG	53	29	73	37	70	50	95	86	47	**439**
13	Volvo	24	18	43	37	70	66	63	50	47	**418**
14	Leapmotor	30	13	18	18	13	5	66	72	53	**278**
15	Great Wall Motor	43	23	35	44	28	27	39	29	20	**276**
16	smart	26	30	28	17	16	17	17	23	12	**186**
17	Neta	9	7	17	17	10	15	17	23	5	**120**
18	Hyundai	–	23	41	36	2	–	–	–	–	**102**
19	Dongfeng	9	3	3	16	15	15	5	8	3	**77**
20	Honda	1	–	–	–	–					

Source: https://paultan.org

Over the last 10 years, the growth of electric vehicles (EVs) in Malaysia has been erratic and lower than anticipated, hence not allowing Malaysia to be one of the first countries to lead in developing sustainable transportation solutions. Historical data of EV registrations from 2010 - 2019 show that during that period, EV requests received little or no response, with the peak EV registrations being in 2017 at about 348. Growth has been on a downward trend since that time. The slow growth is due to several reasons, including a lack of consumer awareness, a lack of charging infrastructure, high cost of vehicles.

Thus, by 2025, there was an exponential increase in the electric vehicle (EV) sales due mainly to the tremendous advancement of new models of EV's that were being manufactured by several leading Chinese Automaker(s) (i.e., BYD); introduction of Proton's all-elevated line of EV's and also Tesla; however, because of the accelerated growth of the market in this region, the electric vehicle (EV) industry will likely be dominated by a relatively small number of automobile manufacturers (i.e., BYD, Proton and Tesla), who will command higher dollar volume sales due to many of the same reasons discussed earlier (i.e., the affordability of their brand; brand loyalty/trust; product distribution/availability etc.), while the balance of all automobile manufacturers will continue to experience significantly lower dollar volume sales. Hence, this disparity of slowing adoption rates versus significantly higher adoption rates between the 2010-2019 timeframe, as compared to 2025, has raised serious concerns regarding the viability and sustainability of the Malaysian EV ecosystem and electric vehicle (EV) industry over the long term.

As per the report of the Ministry of Natural Resources, Environment, and Climate Change (NRECC), it is stated that the acceptance of electric vehicles (EVs) is hindered by various factors. The very first hurdle in the acceptance of EVs is the perception of consumers that the prices of EVs are very high compared to traditional internal combustion engine (ICE) vehicles. EVs indeed have considerably lower operational and maintenance

costs than ICE vehicles; however, the initial high price may scare away a lot of potential customers, especially those who are sensitive to prices, from transitioning to EVs. The third element that influences the consumer's trust in EVs positively or negatively is their own reasoning about the advantages, the total cost of ownership, the government incentives, and the impact of EVs on the environment. Consumers do not have confidence in the benefits, costs, incentives, and environmental impacts of an Electric Vehicle. Because of this lack of confidence, there are false perceptions about performance, battery life, and the hidden costs of ownership of an Electric Vehicle. Prospective purchasers of Electric Vehicles may not view Electric Vehicles as viable compared to conventional vehicles unless they receive sufficient information and promotional efforts to educate and inform them. The third barrier to the adoption of Electric Vehicles by consumers is fear that their Electric Vehicle will run out of battery before they arrive at a charging station or complete their journey. Despite the improvement of the durability of the battery capacity, there is still a significant level of anxiety about being stranded without battery power on long road trips. Until enough charging stations are available for use on the road, consumers will continue to be reluctant to adopt electric vehicles, especially those consumers who frequently travel longer distances.

The country is facing major barriers that hinder the adoption of electric vehicles, which are the primary issues. The major barrier to electric vehicles (Syed Mansor & Anuar, 2025; Singapore Economic Review, 2024) is their exorbitant price; in addition, there is a large difference in government policy between the actual tax revenue generated from EV sales and the subsidies given to consumers who purchase the vehicles (Ismail & Rethina, 2024; Yeap, Radzi & Ghazali, 2023). Besides, the insufficient electricity supply for electric vehicles (EVs) is another hurdle that the Malaysian market must face (Syed Mansor & Anuar, 2025; Md Isa et al., 2025). Moreover, the consumer trust levels differ a lot across the various EV brands (Rahman, Ibrahim & Ismail, 2024; Mohd Yusoff et al., 2023). These obstacles must be solved first for a successful and competitive EV market to be developed in Malaysia.

LITERATURE REVIEWS

At present, the adoption of electric vehicles in Malaysia is limited as the potential consumers face many constraints. One of the main constraints for the low adoption of electric vehicles may be the high purchase cost of electric vehicles compared to conventional vehicles (Chenayah, Devadason, Goh, 2024; Gent, 2019). Many new electric vehicles available in the market are most likely to sell for over RM80,000 which limits the opportunity for many middles to lower income consumers to purchase an electric vehicle. Moreover, there are consumers who are unsure about the future resale value of electric vehicles and the uncertainty of maintenance to replace or repair the battery.

Even though the consumers may find electric vehicles are more affordable to refuel or require less maintenance than a conventional vehicle, the purchase cost of the electric vehicles still represents a major barrier (Syed Mansor & Anuar, 2024; Rahman et al., 2023). In addition, there is evidence from surveys that price sensitivity for consumers will be high and that financial issues will be a major factor influencing their purchasing decisions for EVs (Knez, Jereb, & Obrecht, 2014; Thananusak et al., 2017; Mashrur & Mohamed, 2025).

The Electric Vehicle (EV) charging network represents another key barrier. Urban centres (City-States' Capital Cities) such as the Capital City of Malaysia (Kuala Lumpur), and Urban proliferation States are mainly seen to have a very heavy concentration of EV chargers in Urban areas, but very little to zero (0) EV chargers available in non-urban/non-metro (interior) areas, leading to “Range Anxiety” among prospective EV purchasers. EV owners have limited access to fast DC chargers located in various locations to allow for longer-distance travel. The high cost of EV charger installations is another major barrier to the growth of this type of charging infrastructure, as there are no current laws in place that govern the use of electric vehicles. Also adding to the level of inconvenience associated with using an electric vehicle through the use of Electric Vehicle (EV) charging networks is the fact that they are often operating on a proprietary basis with little to no interoperability, and the lack of trustworthy existing EV chargers can often create a severe level of frustration for those attempting to use the EV charging network. Proposed solutions to create interoperability between multiple EV Charging providers could assist in creating effective solutions for building consumer confidence within the EV charging marketplace.

Tax incentives such as tax exemption, tax rebate, and subsidy are an important driver of the growth of EVs in the marketplace. However, inconsistent short-term government policies can severely restrict the effectiveness of these incentives (Hidayat et al., 2023; Lim et al., 2023). Globally, countries have had great success by combining programs to develop EW through Infrastructure Development and Education. Of these, consumer education is very important to improving the ease of use associated with EW and EV, therefore increasing the likelihood of consumers utilizing EW as their means of transportation. Examples in Malaysia include import duty and excise tax exemptions, and EV home charge tax credits to lower the cost of adopting EV for consumers and lower consumer barriers to participating in EV. The most important barrier limiting the growth and participation in EV Adoption in Malaysia is the lack of extensive and effective Government support through policy creation. Research indicates that while cost savings and environmental benefits of EW primarily motivate some consumers to participate in the EW market, continued Government support is extremely important in converting this awareness into actual purchase of EW; if the Government does not take steps to facilitate purchase decision on an EV, consumers will lose interest.

A company needs to develop confidence and trust with the customer to be able to experience growth throughout its lifetime. The purchase of an electric vehicle (EV) in Malaysia has some major considerations that will impact the customer's purchasing decision: Quality/reliability of the EV, rechargeability of the EV battery, cost of maintaining the EV battery, brand recognition, and expectation of resale value. The EY research conducted recently shows that in 2023, almost 41% of people surveyed had expressed concerns regarding the costs of maintaining EV batteries, and 57% of people had concerns with the expected resale value of EVs (EY2023). Given that EVs are usually seen as new technology that is still in development, it creates a challenge for customers to trust an unfamiliar brand that does not have a history of service or has not established parts to support their product. To be able to build a trusting relationship with customers and establish a long-term trust relationship with EVs in Malaysia, a strong charging infrastructure must be established, along with a warranty on EVs that includes service and support.

The adoption of electric vehicles in Malaysia is lower because of several factors high purchasing price of owning electric vehicles, the insufficient number of charging points (the need for a national charging grid, changing in the government regulations both state and federal levels, and lack of consumer confidence. Thus, to increase the adoption of electric vehicles, the government must invest more by building charging stations all over the country, plus educational campaign has to be supported by government efforts aimed at promoting awareness about the electric vehicles. In addition, Malaysia must focus on holistic strategy that not only reduces the carbon emissions but also strengthens its competitiveness in the global electric vehicle (EV) market, alongside encouraging wider EV adoption (Syed Mansor and Anuar, 2024; Hidayat et al., MDPI, 2022).

Underpinning Theory

The critical problem of achieving sustainable adoption of electric vehicles can be related to the Diffusion of Innovation Theory (Rogers, 2003). This theory explains five dimensions that can influence the adoption rate of electric vehicles. The dimensions are relative advantages, compatibility, complexity, trialability, and observability. In Malaysia perspectives, the relative advantage of electric vehicles in measured by the high cost of purchase compared to conventional vehicles that use petrol. Despite the savings on fuel consumption and maintenance, the high price remains a major reason for consumers (Syed Mansor & Anuar, 2025; Abdul Rahman, Ibrahim, & Ismail, 2024). The second dimension known as compatibility, in which the public charging infrastructures are very limited, focuses mainly on urban areas. This makes the electric vehicles less practical across region, especially those living in rural and semi-urban areas (Yusoff et al., 2023; Faiz, 2025), which further slowing adoption. Third is the complexity of electric vehicle technology which contributes to uncertainty, reluctance, or delay in decision to purchase. This is the case where many consumers are concerned about the battery life, maintenance and brand reliability, which in turn decrease the possibility of using it (Isa, Shamsudin, & Abaidah, 2025; Chai, 2024). This theory also emphasizes trialability and observability; in which innovations are more likely to spread when potential adopters can trial them or see them being used by others. In Malaysia, the limited number of electric vehicles on the road and few public trial programs reduce social visibility and learning opportunities, weakening adoption momentum (Mashahadi, Mahmod, & Mohd Sohid, 2023).

This theory is also connected with the structural and policy issue. Issue such as inconsistent government subsidies and unclear policies create uncertainty thus reduce the consumer interest to adopt electric vehicles (EY Malaysia, 2024; Hidayat et al., 2025). In addition, limited awareness and low consumer confidence make this issue worsen as many potential buyers prefer to hold the buying decision until electric vehicles become more common on the roads and benefits are available (Isa, Shamsudin, & Abaidah, 2025). Altogether, high purchasing costs, insufficient charging infrastructure, consumer perceived complexity, reduced the opportunities to purchase electric vehicles and low visibility explain why adoption of electric vehicles remains low. Therefore, the Diffusion of Innovation theory offers a useful view for understanding these problems and the importance of coordinated government policies, improved infrastructure, and stronger public education efforts to boost electric vehicles adoption and support the development of a sustainable and competitive market.

CONCEPTUAL FRAMEWORK

The conceptual framework illustrates the adoption level of electric vehicles in Malaysia by investigating various factors. First, the high purchase cost which reflects the relative advantages of electric vehicles negatively impact on the consumers' intention to adopt due to premium price over conventional vehicles (Syed Mansor & Anuar, 2024; Rahman et al., 2023). Second variable is insufficient charging infrastructure, which relates to product compatibility. The insufficient charging infrastructure tends to reduce consumer confidence to purchase electric vehicles because of the practicability and convenience, especially in rural and suburban areas where the charging stations are limited (Ahmad, 2023; Carz Automedia, 2024). In addition, the government tax and subsidy such as purchase rebate, import and excise duty exemption and incentives for home charging installation positively contribute adoption of electric vehicles by reducing the initial cost and operational cost of owning the electric vehicles (Zhang et al., 2024; Flühs, 2017; Zhao et al., 2024). Moreover, consistent policy and long-term government commitment enhance the effectiveness of incentives, which in turn provide clarity to consumers and charging infrastructure operators, and reducing perceived risks (Pandak & Rethina, 2024; JBETE, 2022). Consumer confidence attitude as a mediating variable will be incorporated in the conceptual framework, which recognizing Buyers' Perception of Product Cost-Benefit, Product Compatibility, and Government Tax and Subsidies Towards Sustainable Adoption of Electric Vehicles in Malaysia. This hypothetically can strengthen or weaken the impact of financial and infrastructural factors on adoption of electric vehicles (EY Malaysia, 2024; Lim et al., 2023). Therefore, the proposed hypotheses of this paper are as follows:

H1: Buyers' perception of product cost–benefit has a significant positive relationship with the sustainable adoption of electric vehicles in Malaysia.

H2: Buyers' perception of product compatibility has a significant positive relationship with the sustainable adoption of electric vehicles in Malaysia.

H3: Government tax incentives and subsidies have a significant positive relationship with the sustainable adoption of electric vehicles in Malaysia.

H4: Buyers' perception of product cost–benefit has a significant positive relationship with buyers' confidence attitude toward electric vehicles.

H5: Buyers' perception of product compatibility has a significant positive relationship with buyers' confidence attitude toward electric vehicles.

H6: Government tax incentives and subsidies have a significant positive relationship with buyers' confidence attitude toward electric vehicles.

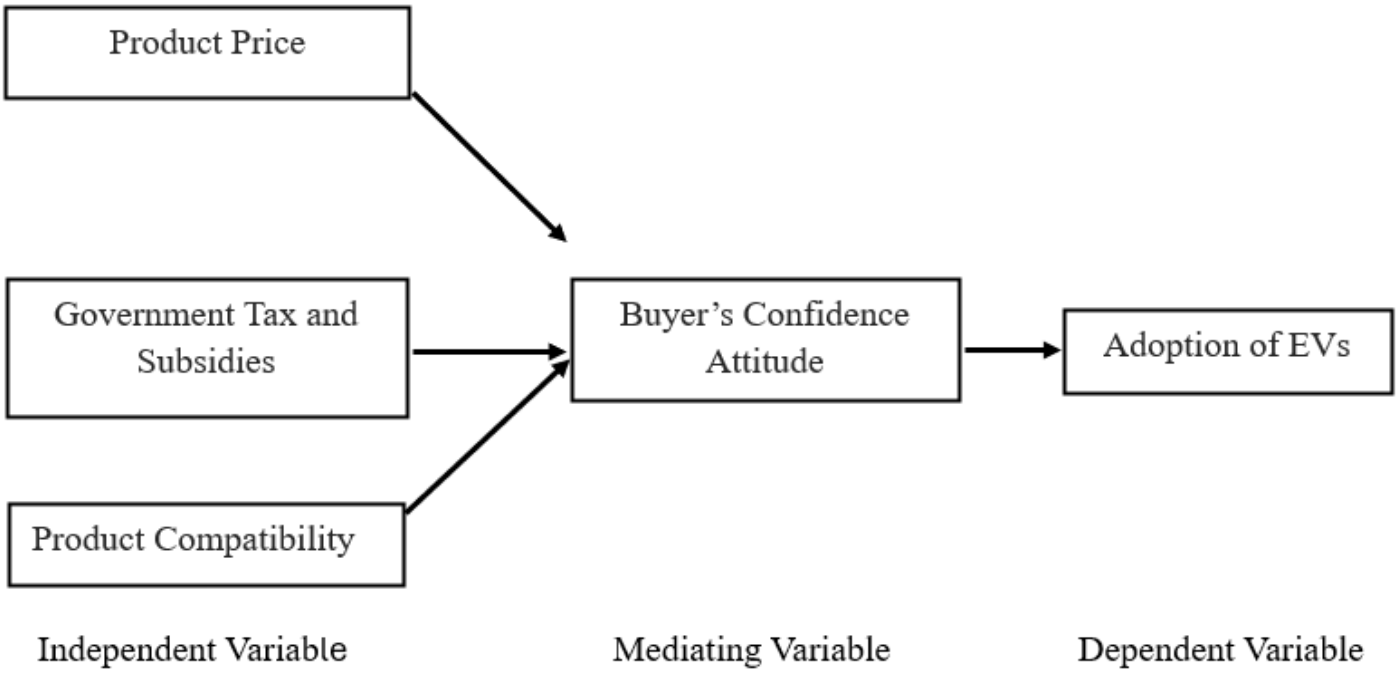
H7: Buyers' confidence attitude has a significant positive relationship with the sustainable adoption of electric vehicles in Malaysia.

H8: Buyers' confidence attitude mediates the relationship between buyers' perception of product cost–benefit and the sustainable adoption of electric vehicles in Malaysia.

H9: Buyers' confidence attitude mediates the relationship between buyers' perception of product compatibility and the sustainable adoption of electric vehicles in Malaysia.

H10: Buyers' confidence attitude mediates the relationship between government tax incentives and subsidies and the sustainable adoption of electric vehicles in Malaysia

Figure 1: Conceptual Framework



RESEARCH METHODOLOGY

This study is implementing a quantitative research design to examine the mediating effect of consumer confidence attitude on factors (product cost, product compatibility and government tax and subsidies) influencing consumer adoption on electric vehicles in Malaysia. Using a cross-sectional survey, the study captures consumers' views and intentions at one point in time, helping to identify the main factors influencing electric vehicle adoption in the country. The population of this study will be the employed Malaysians private vehicle owners between 21 and above. This population is considered broad, practical and widely used in electric vehicles adoption studies. The target population also includes those who are either potential or current electric vehicle consumers with middle to high income groups. According to statistics from paultan.org, there are 26,497 EV users in Malaysia as of 2025, however, the number of potential consumers remains unknown.

The minimum sample size will be determined using Cochran's (1977), suitable with the surveys of which the population is large or unknown. A sample of at least 384 respondents is required to achieve a 95% confidence level with a ±5% margin of error. It is to ensure the survey results are statistically reliable and representative. The selection of the sample size also aligns with Hair (2010), who recommends a minimum total sample of 100–200 respondents, regardless of the number of variables, to ensure meaningful analysis.

A purposive sampling technique will be implemented, which targets potential or current electric vehicle consumers aged 21 and above who meet the study criteria such as awareness of EVs and access to information about EV models and charging infrastructure. This is to ensure the respondents able to provide accurate and relevant views into the adoption of electric vehicles. Data will be collected using survey questionnaire to gather information on factors influencing the electric vehicles adoption in Malaysia.

The questionnaire will be divided into six main sections. The first section will collect demographic information, including age, gender, income, and education level. The second section will explore perceptions of high purchase

costs, including affordability, willingness to pay, and the impact of available financial incentives. The third section will assess policy support, examining respondents' views on government incentives and the clarity and consistency of electric vehicle-related policies. The fourth section will evaluate charging infrastructure, focusing on accessibility, convenience, and availability of both public and private charging stations. The fifth section will examine consumer confidence, investigating trust in electric vehicles brands, perceived reliability, safety, and potential resale value. Finally, the sixth section will gauge perceptions of the sustainability of the electric vehicle industry, including its long-term viability and contributions to environmental and economic goals. All questionnaire items will be measured using a 5-point Likert scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree, allowing for consistent and standardized assessment of attitudes and perceptions across all variables.

Table 3: Operationalization of Variables

Variable	**Type**	**Measurement**	**Source**
High Purchase Cost	Independent	Affordability perception, willingness to pay	Syed Mansor & Anuar (2024)
Tax and Subsidies	Independent	Perceived consistency, clarity of government incentives	Hidayat et al. (2023)
Charging Infrastructure	Independent	Accessibility, convenience, availability of stations	Ahmad (2023), Yusoff, et al. (2023).
Confidence attitude	Mediating	Trust in EV brands, perceived reliability and safety	Qin, H., & Li, Z. (2025).
Sustainability of EV Industry	Dependent	Perceived long-term viability and environmental/economic impact	MDPI (2022)

By referring to Table 3, high purchase cost is measured through consumers' perceptions of affordability and their willingness to pay for electric vehicles (Syed Mansor and Anuar, 2024). High prices can hinder potential buyers, reduce adoption thus affect the long-term growth of the industry. Government tax and subsidies are measured through perceptions of the clarity and consistency of government incentives, such as subsidies and regulatory support (Hidayat et al. 2023). Effective government tax and subsidies policy can help reduce the negative impact of high purchase costs, encouraging better adoption and supporting industry sustainability. In addition, charging infrastructure is measured by the accessibility, convenience, and availability of charging stations, as highlighted by Ahmad (2023) and Yusoff et al. (2023). The consumers may experience anxiety therefore reduce their likelihood of adopting electric vehicles when the charging facilities are limited. In this study, consumer confidence attitude is measured by three elements which are trust in electric vehicle brands, perceived reliability and safety (Li, 2025). These elements reduce the perceived risks thus increasing the customer adoption of electric vehicles and contributing to the industry's sustainability. Whereas, the sustainable adoption of electric vehicles is measured by perceptions of the long-term viability of the sector, including its environmental and economic contributions.

The Structural Equation Modeling (SEM) together with AMOS software will be used to analyze the data. It allows a detailed and complete examination of both measurement model and structural relationships among the variables. Confirmatory Factor Analysis (CFA) will be used to ensure all constructs show a strong convergent and discriminant validity, which validates the measurement model. Cronbach's alpha and composite reliability are used to measure reliability, while the average variance extracted (AVE) will conducted to measure construct validity. Model fit will be evaluated using indices (Chi-square/df, CFI, TLI, RMSEA, and SRMR) to ensure the model accurately represents the observed data. The structural model will be analyzed to test the relationship between the independent variables and the dependent variable. The significance of path coefficients will be tested at p-value = < 0.05, allowing an assessment of the strength and direction of relationships between variables.

Research outcome

This study contributes to the understanding of the adoption of electric vehicles by applying the Diffusion of Innovation theory. To be more specific, this research focuses on how buyers' perception of product cost-benefit, product compatibility, and government tax and subsidies influence the sustainable adoption of electric vehicles in Malaysia. Even though these factors seem to influence the adoption, electric vehicles are still considered as high-risk products. Thus, to strengthen the theoretical contribution of this study, buyer confidence attitude is treated as a mediator as it reflects the psychological process through which structural and economic conditions influence the adoption of electric vehicles. Therefore, the inclusion of buyer's confidence attitude is used to measure the trust in its reliability, safety, long-term value, and policy stability. In addition, grounded on the Diffusion of Innovation theory, buyer confidence acts as an attitudinal filter, connecting perceptions of relative advantage and compatibility to actual adoption decisions. By positioning buyer confidence as a mediator, this conceptual paper adds to the electric vehicle adoption literature by showing favorable economic or policy conditions alone are not enough to drive adoption. In fact, they must first build consumer confidence.

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